THE MOHANPUR EXPERIMENT IN

Natural Farming

The First & Second Interim Reports

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The Mohanpur Experiment in Natural Farming

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A small experiment in
eco-development through low-energy, natural farming

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INTRODUCTION

> Would it not be well to consult Nature for she is the most experienced planter of us all?
>
> *Thoreau*

> We can no more manufacture a soil with a tank of chemicals than we can invent a rain forest or produce a single bird. We may enhance the soil by helping its processes along, but we can never recreate what we destroy. The soil is a resource for which there is no substitute. Like the earth itself, it is a network of activity that we cannot yet understand let alone replicate.
>
> *Donald Worster*

THIS IS A REPORT regarding a two-year old experiment that has been conducted jointly by (i) certain farmers of a remote village called Chanda Nangli Mohanpur in Bijnor district; (ii) certain staff members of the Centre for Energy Studies and the Centre for Rural Development and Appropriate Technology at IIT, Delhi and (iii) the research wing of the Gandhi Peace Foundation.

The purpose of the experiment has been to investigate a new route to development, a route that is different from that generally pursued these days. In modern civilization, development has been seen as largely material in connotation, with concepts like GNP and per capita income being used to measure progress. Accompanying this has been the desire to 'conquer' nature, with every new technology being regarded as an additional victory in this battle. This being the approach, little wonder that development has led to a breakdown of the natural ecology that sustains the earth.

Is it possible to avoid this breakdown of ecology, the disastrous consequences of which are now becoming evident? Can we human beings not enhance our material well-being while simultaneously contributing to, rather than

taking away from, the ecological balance? In other words, do our technologies *have* to adopt a confrontational attitude towards nature?

This is the central question we are seeking an answer to. Because of its critical importance for human sustenance, we have chosen food production as the arena for our experiment and are investigating the feasibility of a relationship with land which represents a denial of all that is considered 'progressive' in farming: no fertilizers, no chemicals, no pesticides no prepared compost, no weeding, *not even tilling*. Instead, the soil is cared for and the natural ecology of the land preserved as far as possible. Our investigation centres around whether it is possible to procure enough food grains, both in quantity and quality, by thus 'tuning in' with nature and with our own inner selves.

The theoretical foundations behind the view of the universe underlying this approach to development have been investigated by us from 1977 onwards through intensive research and informal 'study circle' meetings, both at IIT and Gandhi Peace Foundation. These investigations have included many new and interesting developments in the physical, life and social sciences, such as the new theories of human and social evolution put forward by Eric Jantsch and also by Arthur Young, Schumacher's ideas on education and on economics, Karl Pribram's work on the neurophysiology of the human brain and his holographic paradigm to explain reality, Hoffstadter's thesis linking the genius of Gödel, Escher and Bach, the pioneering work on a new line of medical researchers such as Elizabeth Kubler-Ross and Larry Dossey, Sheldrake's morphogenetic field theory to explain biological growth and, most important, several exciting developments in physics, starting with relativity and quantum theories that originated in the early part of this century, right upto recent developments such as Prigogine's dissipative structures and the new interpretation of chaos and order in nature based on non-linearity. Prof. D.S. Kothari, the eminent scientist, has been a great source of inspiration and encouragement in these studies.

The big opportunity for putting the theory of development that we were formulating to a practical test came into view with the publication of the book *One Straw Revolution* by the Japanese researcher-farmer Masanobu Fukuoka. In

it, he has described how, following the spiritual experience that is referred to as *Mu* in the Japanese Buddhist tradition, he felt inspired to 'swim along with the tide' of nature, rather than to battle it as is recommended in modern agriculture.

For 50 years, Fukuoka has sustained a viable alternative to modern methods of farming by abandoning fertilizers, pesticides, chemicals, composting, even tilling, and instead treated the earth as a living organism which, playing the role of mother to us, *wishes* to provide us with plenty. What Fukuoka recommends, based on his long experience, is a new relationship between man and his universe (including fellow human beings) in which the non-material side of human development is brought into focus and stressed, but which also nevertheless leads to excellent results from the material point of view. This revolutionary approach to farming, we discovered, was already being experimented with in a few places in India, and seemed to provide an ideal setting for trying out some of the ideas we had developed on the theoretical side.

The major credit for being able to develop these theoretical ideas into a practical experiment goes to Shoor Vir Singh, a resident of Mohanpur village where his family has been living and farming for generations. He responded positively to our ideas when approached by his brother Dr. Yash Pal Satya of the Centre for Energy Studies at IIT. Dr. Satya has been an active member of our study circle since 1979 and has linked his ecological and spiritual pursuits with the latest developments in theoretical physics, especially those with regard to non-linear systems.

Shoor Vir readily came forward to try out the 'natural farming' idea on 1½ *bighas* of his land in the 1985-86 season, and from May 1987 has extended the experiment to cover 3 acres. In addition, since May 1987, Shoor Vir has been assisted by Rajinder Singh, another farmer from this region. Sonath Pradhan, also a farmer of the village, and Atul, Shoor Vir's younger brother, have also been of valuable assistance in the conduct of the experiment. Maharaj Singh, a farmer from a neighbouring area, has also taken keen interest.

The results from the kharif crops of 1987 have just come in. It is our first harvest after extending the experiment to three acres and so our conclusions are tentative and guarded. However, they are sufficiently encouraging for us to want to share our experience with a few friends, acquaintances and

well-wishers. This report has been prepared with this object in view.

The major part of the report was written in Hindi by Yash Pal Satya and Shoor Vir Singh and we have retained it that way. For those who read English, T.S. Ananthu, Research Fellow at the Gandhi Peace Foundation has prepared the *Overview* that follows. This *Overview* gives a gist of the results obtained from the experiment so far and it also links this experiment with the new approach to development that forms its basis. Consequently, it is divided into four parts:- (i) Introduction (ii) Food Production - the Current Scene (iii) Towards an Ecological, Holistic Technology and, finally (iv) the Mohanpur Experiment.

Apart from the three writers of this report, many others have also made significant contributions to the experiment. Mention has already been made of Prof. D.S. Kothari, Rajindra Singh, Sonath Pradhan, Atul and Maharaj Singh. From IIT Delhi's Centre for Rural Development and Appropriate Technology, Dr. (Mrs.) Padma Vasudevan and Dr. (Mrs.) Santosh Satya have assisted in the formulation and execution of several ideas and have been important members of our team. Shri Partap Agarwal and Dr. Alok Sagar have rendered very valuable assistance and guidance based on their previous experience in a similar experiment at Rasulia in Hoshangabad district of M.P. Shri Radhakrishna, Secretary of the Gandhi Peace Foundation, has given his full backing to our efforts and has aided the execution of the project in many ways. Shri Anupam Mishra and Shri Ramachandran Potti of the Gandhi Peace Foundation have also been of great help. The encouragement that Dr. Pradhiman Kaw has been giving to Dr. Satya has been of great value to us.

Anyone is welcome to visit the farm at Chanda Nangli Mohanpur and see the results for himself or herself. To get there, one has to reach Bijnor town, take a bus to a village called Nangal-Jat about 10 km. away, and then travel along a *kutcha* path for another 2 km. or so. There is no public transport available after Nangal-Jat, but it is possible to ride on bicycles or bullock-carts along the *kutcha* path.

Those unable to visit the farm in person are welcome to see the slides and photographs we have taken showing the results of the experiment at various stages.

OVERVIEW

Mahatma Gandhi had used unusually strong terms (such as 'satanic') to condemn what we call 'modern civilization', but his ideas in this regard had been dismissed at that time as quaint and impractical even by those who otherwise had developed a strong admiration for him. He himself acknowledged his failure to convince anyone bar a handful. One of the principal reasons for this failure was the apparent conflict between Gandhi's ideas and those of modern science, which forms the foundation of modern civilization.

But of late, there are signs of a deep soul-searching within science itself. This could well result in bridging the gap that prevented us from understanding the deeper meaning of what Gandhi had in mind, for what is being questioned is the materialistic, reductionistic attitude that we have adopted in the name of science. One of the recent books* that deals with those developments puts it this way:-

> Science and its sister, technology, are full of surprises - so many surprises it's difficult to be surprised anymore. Black holes, genetic engineering, dust-sized computer chips - what next? We're ready for anything. The theories and artefacts of science have long since become firmly established on our landscape, spreading

*This book is titled "Looking Glass Universe" and sub-titled "The Emerging Science of Wholeness: the new revolution in physics, mathematics, chemistry, biology and neurophysiology". Jointly authored by Briggs and Peat, it deals mainly with the work of the physicist David Bohm, the neurophysiologist Karl Pribram, the physical chemist Illya Prigogine and the biologist Rupert Sheldrake.

and changing like a city's skyline. We've all become inhabitants in this city. Around us new structures rise, re-development projects take place as discoveries come and go. We take it in, rather jaded by this fast-paced and dazzling environment.

But lately, faintly, there has been a rumbling of the ground, a change in the light: mysterious signs. Strange reports reach us from people who have been working beneath the ground, in the deepest structures of the city, that they may have uncovered something, stirred something, which could drastically change the city and all who inhabit it. We have called the theoreticians who bring us these reports scientists of the looking-glass. They have a deep surprise in store for us, they say deep, because it is a surprise at the very foundations of science.

A re-examination of the foundations of science automatically amounts to a critical appraisal of modern civilization itself. Once this exercise is undertaken, it opens up a whole new way of viewing man and his relationship with the universe including his fellow-beings. This is particularly important in dealing with the many seemingly insoluble crises that mankind is facing today. If we are willing to abandon the materialistic, reductionistic attitude that characterizes modern civilization, we are then able to investigate whether a new form of development (what we have termed 'eco-development') may be the answer to our problems.

Food Production - The Current Scene

These seemingly insoluble crises are typified by the situation prevalent on the food front. Technologies to increase food production are one of our top scientific priorities. And yet, hunger and malnutrition and starvation are as widespread as ever. Why is that the case? 'Inequitable distribution' and 'need for still better technologies' have been the two standard answers to this question so far. Consequently, massive investments in new technologies have taken place, and so have attempts in many countries to socialize the distribution system. But the problem has not gone away; instead, it seems to have worsened. Should we

continue to accept these two answers or is it time to re-think our entire approach to the question of science and technology? This is the central question that our experiment attempts to deal with.

This question has become all the more critical because of a number of disturbing trends that are appearing on the agricultural front. To mention a few:-

1. Every season, huge piles of essential food items - sometimes potatoes, sometime cauliflower, sometimes sugarcane, sometimes apples, sometimes butter - are deliberately and systematically destroyed through poisoning or burning even though, at that very moment, millions are dying of starvation. Why does such a terribly paradoxical situation arise? It is not just a question of greed on the part of the food growers, it is also a question of where and how the food is being produced. Modern agricultural technology has resulted in monoculture, and the wilful destruction of valuable crops is a direct result of this. Huge stocks build up in one area, but the demand for that particular item is in an entirely different area. Thus, while modern farming technologies may have increased yields, they have also brought about situations forcing the destruction of yields.

2. The cost of inputs has been skyrocketing, but their effectiveness diminishing. For example, Graph No.1 (Pg. 42) shows how the cost of developing a new pesticide has shot up nearly 40 times between 1956 and 1984. The price the consumer has to pay for it has risen even more sharply - e.g. one kilogram of DDT used to cost only 40 cents in the USA in the 1950s and 1960s but the new pesticides are being sold at rates ranging from $90 to $900 a kilo. The situation is even worse in countries like India, for the know-how has to be imported and we are at the mercy of the multinationals and others who own the patents.

3. One may conclude that the higher costs of newly developed inputs means better effectiveness, for they represent more advanced technologies. But in many cases the fact of the matter is *just the opposite*. This paradox is evident from Graph No. 2 (Pg. 42) which shows the number of insect species that have become *resistant* to our pesticides. In 1935, only seven insect species refused to run away or die when chemicals were sprayed, but by 1986, despite the

development of far more potent and poisonous pesticides, this number has gone up to 462. It is evident that as we are engaged in research aimed at discovering more powerful pesticides, the insects are not meekly submitting to extinction but have been furiously engaged in research of their own to discover ways and means of survival. Thus, unlike in the case of cars or satellites or computers, our 'advanced' technologies in agriculture represent a game with other *living* organisms, which often emerge victorious in the long run. We therefore get caught up in an ever-increasing spiral of new and costlier technologies merely to offset the diminishing effectiveness of the earlier ones.

4. Excessive erosion of top soil as a result of our anti-ecological practices in modern farming also poses a grave threat to land productivity. The earth's top soil is a sacred and special endowment from nature to us. Instead of preserving and building on this endowment, we are depleting it in the name of 'higher output' from land. In some areas of the world where modern farming techniques have been used more intensively, the first signs of desertification are already beginning to appear.

5. Wherever modern farming technologies have been introduced, there has been an alarming fall in the ground water level. For example, in that portion of Bijnor district which forms the site of our experiment, the water level was between 10 and 15 ft. in 1970. But, since then, with the introduction of modern technologies to enable large-scale sugarcane cultivations, the level has dropped continuously, and now stands at 42 ft.

6. While the quantity of food production may have gone up as a result of modern technologies, the quality has definitely gone down. The use of pesticides and chemicals is adversely effecting human health and well-being.

7. The economics of farming is undergoing major changes, with small and medium-sized farmlands becoming totally uneconomical. In India, even a 10-acre farm is now insufficient to sustain a nuclear family of four or five members. In countries like the USA, farmers holding 200 to 500 acres of land are finding themselves forced to declare bankruptcy. Literally millions of farmers the world over are finding it difficult to make both ends meet.

How come this threat to the traditional livelihood of millions, and the severe crises that the farming communities are facing, have not made banner headlines in our newspapers? Even if a factory employing just 50 people were to shut down, does it not draw widespread attention, sympathy and ameliorative action? The reason perhaps lies in the fact that the farmers live in dispersed communities, far away from the cities where our newspapers are published.

Gandhi had always maintained that such an urban-oriented, centralized approach to human affairs results in a distortion of our priorities, and is one of the principal sources of our current problems. He did *not*, as is often made out, advocate either an abandonment of all technologies or an idealization of village life in its existing pattern. As he clarified to Nehru:

> You will not understand me if you think that I am talking about the villages of today. My villages today exist in my imagination. After all, every person lives in the world of his own imagination. The villager in this imagined village will not be apathetic - he will embody pure consciousness. He will not lead his life like an animal in a squalid dark room. Men and women will live freely and be prepared to face the whole world. The village will not know cholera, plague or smallpox. No one will live indolently, nor luxuriously. After all this I can think of many things which will have to be produced on a large scale. Maybe there will be railways, so also post and telegraph. What it will have and what it will not, I do not know. Nor do I care. If I can maintain the essence, the rest (will follow), and if I leave the essence, I forsake everything.

Gandhi's vision of a post-modern civilization was centred around this essence: of human beings striving to embody 'pure consciousness'. He bemoaned the fact that the modern world has lost sight of the wonderful education processes that lead to real spiritual development - to love in its pure, universal form. He was not, as he clarified, against technology even of the large-scale variety. What bothered him about modern civilization was that intellectual pursuits were encouraged but spiritual ones were not, and hence our tech-

nologies turned out to be reductionistic and materialistic in character. He envisaged a new array of ecological, holistic technologies whose import and consequence would be different from the present ones if we linked our scientific pursuits to the 'embodiment of pure consciousness'. To quote his powerful, predictive words:

> Modern science is replete with illustrations of the seemingly impossible having become possible within living memory. But the victories of physical science would be nothing against the victory of the Science of Life, which is summed up in Love which is the Law of our Being.

It is evident that Gandhi did not dismiss science or its accomplishments, but spoke of a new kind of science that would lead to far better, more miraculous technologies. At the core of this new science would be 'the Science of Life which is summed up in Love which is the Law of our Being.' This represents a revolutionary approach to science, in which laws governing the universe are sought to be discovered not merely at the level of matter, but at the level of the transcendent, immanent Creator. Technologies based on such a science would therefore, naturally stress creativity rather than productivity as at present, and would be holistic, ecological in character.

The technology that we have chosen for our experiment seems to represent an approach of the kind that Gandhi had in mind. It was first espoused by Masanobu Fukuoka, a Japanese farmer with formal training and research experience in agricultural science. At the age of 25, he had a spiritual experience which in Japanese Buddhist terminology is referred to as *Mu* (perhaps the equivalent of *Sunyata* or 'nothingness' in the Indian Buddhist traditions). As a result, he began to realize that the 'I' is actually a nothing, a zero (recall that Gandhi's ultimate goal was 'to reduce oneself to a cipher'). But he also realized that the farming he was then practising represented the opposite philosophy: the 'I' is elevated to the highest, and we assume that men are capable of changing everything, from the productivity of land to the shape and taste of tomatoes. Fukuoka then began changing his farming practice to conform to his new view of the universe, and after 50 long years of experience had evolved

four basic principles of what is now called 'do-nothing' or natural farming. These are:

1. *No cultivation, that is, no ploughing or turning of the soil.* For centuries, farmers have assured that the plough is essential for growing crops. However, non-cultivation is fundamental to natural farming. The earth cultivates itself naturally by means of the penetration of plant roots and the activity of micro-organisms, small animals and earthworms.

2. *No chemical fertilizer or prepared compost.* If left to itself, the soil maintains its fertility naturally by developing an ecological balance in accordance with the orderly cycle of plant and animal life. Artificial efforts to increase productivity create wounds in the soil which ultimately drain away essential nutrients and deplete the fertility.

3. *No weeding by tillage or herbicide.* Weeds play their part in building soil fertility and in balancing the biological community. As a fundamental principle, weeds should be controlled, not eliminated. Making a mulch using straw, providing a ground cover of white clover, and temporary flooding are examples of how this controlling can be accomplished.

4. *No dependence on chemicals or pesticides.* Nature, left alone, is in perfect balance. Harmful insects and plant diseases are always present, but do not occur in nature to an extent which requires the use of poisonous chemicals. The sensible approach to disease and insect control is to grow sturdy crops in a healthy environment.

Each of these four principles represents a complete 'about-turn' from all that is considered progressive in modern farming. In particular the first one is a breathtakingly revolutionary approach, for cultivation and farming are terms used almost synonymously. Is it really possible to grow anything without cultivation? Fukuoka not only claims to have done so for 50 long years, but his output results (verified by independent agencies) compare favourably with the best of modern farms even by the high standards of Japan. His rice output has been close to 1300 pounds per quarter acre, and so have his wheat and barley outputs. His new book, *The Natural Way of Farming: The Theory and Practice of Green Philosophy* contains a detailed documentation of his results, along with pictures of the farm at various

stages. His earlier book *The One Straw Revolution* spells out the principles behind his approach.

That Fukuoka's revolutionary technology is ecological in nature is self-evident, for the whole aim is not to interfere with nature's ecological balance. That it is holistic may not be that evident at first sight, but we must not forget that he arrived at this idea through a spiritual insight, in which he viewed the universe as a 'whole', not by the usual 'you-and-me' dichotomy through which we view it when analyzing things intellectually. That is why Fukuoka's entire stress is on taking good care of the soil, which he regards as Mother Earth, and with which he attempts to develop a bond akin to that of mother and child, where the 'you-and-me' dichotomy is minimized.

The term 'do nothing farming' is often misunderstood to mean the escape route of a lazy farmer afraid of physical labour, but it actually means: do nothing that will go against the grain of nature, that may harm the 'mother-son' relationship which binds the land to the farmer. All his four principles are a direct derivative of this basic relationship: why poke, despoil, interfere with or pour poison into that which is like our mother, which provides us with the sustenance of life? Why not instead cover her nicely with a straw mulch so that she is protected from sun and rain alike? Fukuoka's entire effort is aimed at showing that if this is done, then mother earth bestows on us a bounty which our artificial methods cannot extract from her. Therefore, his technology is akin to 'swimming along with the tide' of nature by 'tuning in' to her (and to our own inner selves), rather than adopting an attitude of confrontation as we have done in modern civilization.

Within the confines of his four principles, Fukuoka encourages innovation and creativity. There are no standard 'procedures' for natural farming. Each farmer has to build up his own relationship with his piece of land, and learn to be creative. Like in any mother-child relationship, there can only be broad guidelines and principles, not set rules.

This technology is therefore one that suited our purposes ideally, and we launched the experiment at Mohanpur on its basis.

The Mohanpur Experiment

This experiment at Mohanpur is not the first attempt at natural farming in India. For almost nine years now, the Friends Rural Centre at Rasulia in Hoshangabad district of M.P. has been working in a similar direction under the guidance of Shri Partap Agarwal, and their annual reports describe their results in detail - a few problems, some failures, and also some encouraging success stories, especially with respect to paddy. There may also be other such efforts, and we have heard of one at Agaly in Palghat district of Kerala. We also know of Raju Titus in Hoshangabad, who is in the process of converting his 13-acre farm to this method. Perhaps there are several others whom we are not aware of.

There are however, a few distinguishing points of the Mohanpur experiment that are worth bearing in mind:-

1. It is not an experiment confined to farming alone, but an integral part of an investigation into alternatives to modern civilization. This experiment, therefore, should not be viewed in isolation, but in conjunction with our study and research into various aspects of science, technology and society that could be clubbed together under the general title 'eco-development'.

2. The results of the experiment are being monitored very closely and accurate data is being preserved right from the start.

3. The farm on which we are doing the experiment is in conjunction with other normal farms, in the midst of a regular farming community. Therefore, the results obtained are very realistic in terms of a possible replication of the experiment elsewhere. The presence of other farmers in the vicinity also makes a dialogue on 'eco-development' with them easy.

The principal executor of our experiment, Shoor Vir Singh, comes from a family of farmers settled in this village for generations. After completing his B.Sc. in Microbiology from Ahmedabad, Shoor Vir preferred to go back to his village and live off the land. The family's holdings now total a little less than 9 acres, but divided into plots that are not all contiguous.

Shoor Vir's brother, Yash Pal Satya, was the first among our study circle members to come across Fukuoka's book 'One Straw Revolution'. After a visit to Rasulia in Dec. 1985, he felt like persuading his brother to try out an experiment along these lines. Shoor Vir, it turned out, did not require much persuasion. He was already concerned at the negative effects of modern farming, and as far back as 1983 had set aside 1½ *bighas* of his farmland where he was experimenting in farming without fertilizers and pesticides. Fukuoka's 'no tilling' concept was of course new to him, but he responded to his brother's suggestion positively because he preferred an ecological approach to nature and a mother-son relationship with the earth. He told us that on this plot of 1½ *bighas* he had performed a very light ploughing on Oct. 26, 1985 and offered to refrain from any further ploughing so that we could begin our experiment on it straightaway.

So, our experiment began with the rabi season of 1985-86. Mutter and sarson were sown, and the harvesting was done in April 1986. The output was 140 kilograms of mutter and 25 kilograms of sarson. This mutter output was considerably higher than those of the neighbouring farmers who had used fertilizers. Theirs averaged 50 to 60 kilograms per *bigha*, compared to 90 kilograms in our farm. The sarson output was poor by comparison. Perhaps the unseasonal rains that lashed the area in Feb-March 1986 was the cause behind this.

After harvesting the mutter and sarson, the rest of the plant and straw was not used as fodder or burnt as is the normal practice, but was put back on this 1½ *bighas* of land to act as mulch.

This covered land presented a very different picture from the rest of the neighbourhood, which was naked land exposed to the searing summer sun. Slowly, the straw became converted into soil, and various grasses (including those which are regarded very unfavourably by farmers, such as 'dhoobda') made their appearance. So did various insects and other creatures, including snakes.

We kept observing these changes that were taking place in this small piece of land. The farmers of the area looked askance at what Shoor Vir was doing, convinced the land would turn 'banjar' (a wasteland). The pressure from friends and neighbours to abandon this 'foolish' experiment mounted,

but Shoor Vir resisted the temptation to please them. He felt the land was actually gaining in production capacity rather than becoming a wasteland, for he could feel the soil becoming soft and rich.

During the 1986 kharif and 1986-87 rabi seasons, Shoor Vir tried out various small experiments on this 1½ *bighas* of land which he has described in detail in the Hindi section of this report. The rice crop in the kharif season did not give much yield because of the failure of the monsoon, but the sarson and masoor crop in the rabi season was much better. Of much greater importance then the harvest, however, are some of the other observations that Shoor Vir reports. One is regarding the ability of the roots to keep themselves alive because of the 'no tilling' policy, with the result that in a new season the plants can yield flowers and fruits even without being sown. The other is the ability of the plants to grow and yield healthy grains despite the presence of so called 'competitive' or 'dangerous' weeds and grasses.

Having watched the changes taking place in this small piece of land for a full year, we became convinced that even though it had been 'left to itself', the land had actually become more fertile and alive. So, in April 1987, we decided to experiment at a more serious, extended level. Shoor Vir agreed to set aside three acres of land for this purpose. Of this, approximately one acre had on it sugarcane that had been planted earlier, which we left standing so that it can be harvested this winter. On the rest of the land, we commenced the experiment in right earnest. We left it completely unploughed, and instead covered it with cut straw from the rabi crop of 1986-87. Rajinder Singh, another farmer from a nearby village, agreed to help Shoor Vir with the experiment and so did Atul and Sonath Pradhan. Together, they 'broadcast' the following varieties of seeds on this land for the kharif season of 1987:-

1. Dhaan (rice)
2. Urad Dal
3. Bajra
4. Samai, a local grain that can be eaten as rice, used for porridge, or ground like wheat
5. Sann, a plant that is used for making rope
6. Several other seeds such as arhar, moong, jowar, etc., so that a multi-cropping pattern is reflected.

The major crop was dhaan, which is normally grown in paddy fields by the method of transplantation. Therefore, growing it 'naturally', without resorting to tilling, was quite a revolutionary step. For purposes of comparison, we also planted the same variety of seeds in one corner of the and after tilling just this bit of land.

This kharif crop has just been harvested, and the results are quite encouraging. In the case of dhaan, the major crop, the output works out to 1.25 quintals per *bigha*. In that small portion of the land where tilling had been done the output is actually lower - 1.0 quintals per *bigha*. The urad, bajra, samai and sann harvests were also plentiful, though we don't have the exact quantitative figures at the time of writing this report.

How does this output compare with that of modern farming. A farmer in the Bijnor area, using heavy doses of fertilizers and chemicals, and tilling with the help of a tractor, can get upto 3 quintals per *bigha*. This figure of 3 quintals is definitely far higher than 1.25, but five factors should be borne in mind while making a comparison:-

1. The figure of 3 quintals per *bigha* is the upper limit that a lucky farmer gets in a good season. The average is much less.

2. This 3 quintals per *bigha* output can be obtained only in a monoculture pattern. In our case, many seeds other than dhaan were also sown in the same land. Therefore, comparing the figure of 3.0 with 1.25 can be misleading.

3. The cost of inputs required to obtain the yield of 3 quintals per *bigha* is so high that in terms of economics, an yield of 1.25 without inputs is a more attractive proposition. At least two-thirds of the farmer's revenue obtained by selling the 3 quintals per *bigha* output gets consumed in the fertilizers, pesticides, chemicals and diesel he has to spend on.

4. The risk factor is also important from the farmer's point of view. There are so many uncertainties that the risk of a poor harvest is ever present, however many precautions he may take. In the event of a poor harvest, inputs become a dead loss and consequences take the form of a long-term burden on the family because of the loan system the farmer is forced to become a part of. But if inputs can be avoided, even a poor harvest is easier to live with.

5. The revenue to the farmer depends not only on the quantity but also on the quality of output. The quality of output from our kharif crop is definitely of a very superior kind. This is particularly true with regard to dhaan, urad and sann. We have preserved samples from the harvest, and anyone is welcome to examine them.

Apart from the quantity and quality of output, the following interesting observations were made during this kharif season:-

1. The land has become 'alive', with various insects, birds and other creatures making it their home. Bees, snakes, spiders etc., can be found in much larger numbers than in those of the neighbouring farms.

2. The land has also become soft and fertile, with each of the insects or creatures seeming to play a role in keeping it so. Thus, the earthworms and the 'makoras' seem to be performing the task of tilling that the farmer took upon himself previously.

3. Even the so-called harmful insects seem to be playing a positive role. For example, we were rather scared when the termites appeared. Would they eat up our plants, the way they reportedly did in the farm of a friend of ours who had embarked on a similar experiment? We kept our fingers crossed, but discovered that the termites eventually proved useful allies, attacking only the cut straw and converting them into useful, soft soil but leaving the crop-bearing plants alone. We still have our fingers crossed as far as the rats are concerned. They have made deep furrows into the land, and even the brave Shoor Vir is apprehensive as to whether the rabi crop of 1987-88 will belong to us or to the rats.

4. Many weeds and plants are automatically appearing on the farm. Among them are some whose usefulness in herbal medicine is well-recognized by the ayurvedic practitioners of the area.

5. Even weeds that have hitherto been regarded as harmful have not prevented the plants from bearing fruit. For example, urad dal has grown in the midst of weeds known as 'chidia badi', and channa crop has done well even in the midst of dense layers of the weed known as `dhoop'.

The straw from this kharif crop is now back on the land as mulch, and the rabi crop has been sown - wheat, sarson,

INTRODUCTION

THIS IS THE SECOND INTERIM REPORT regarding an experiment that has been conducted since December 1985 jointly by (i) certain farmers of a village called Chanda Nangli Mohanpur in Bijnor district of Uttar Pradesh, (ii) certain staff members of the Centre for Energy Studies and Centre for Rural Development and Appropriate Technology at IIT, Delhi, and (iii) the Research Wing of Gandhi Peace Foundation.

The focus of the experiment is to investigate the possibility of farming in Indian conditions using the 'eco-development' concepts put across by the Japanese farmer, Masanobu Fukuoka. The four basic principles enunciated by Fukuoka are: (i) no tilling, (ii) no chemical fertilizer or prepared compost, (iii) no weeding by tillage or herbicide and (iv) no dependence on chemicals or pesticides. Instead, the farmer develops a 'mother-child' relationship with his land, and adopts certain procedures to help re-generate the ecology of the land, and enrich its soil. Within the parameters of these broad principles, we have tried out various ideas and innovations on a three-acre plot in Mohanpur village. Part I of this report gives an overview of these experiments and the results obtained.

Part II seeks to spell out why researchers at GPF and IIT decided to get involved in this project: how a Study Circle was born ten years ago to investigate the link between some new developments in science (staring with Relativity and Quantum theories) and Gandhi's vision of an alternative to modern civilization, and how Fukuoka's ideas caught our imagination two and a half years back as a good example of a technology that represents this link and could provide an answer to many problems in our agricultural sector that are a result of the modernization process.

Part III of the report is in Hindi, and therefore available as a separate module. It has been written by Shoor Vir Singh, the farmer at Mohanpur, on whose plot the experiment is being conducted, and mainly consists of extracts from the detailed records that he has maintained.

Part I: The Experiment

This experiment is being conducted at a farm that belongs to Shoor Vir Singh, a farmer in Chanda Nangli Mohanpur village of Bijnor district in Uttar Pradesh. Shoor Vir is being assisted by Rajinder Singh, Sonath Pradhan and Atul in his tasks on the farm. Diagram No. 1 (Pg. 43) gives the location of this farm and of Mohanpur village with respect to Bijnor, Meerut, Haridwar and New Delhi. The farm as well as the village are accessible through a 'kutcha' path from Nangal Jat approximately 1½ kms. away. Nangal Jat is connected by a bus service from Bijnor, via Jhalu, but beyond Nangal Jat one has to travel either on foot or bicycle or by bullock cart.

Shoor Vir's family has been resident in the village for decades. His brother, Dr. Yash Pal Satya, teaches at IIT, Delhi, and has been an active member of the informal Study Circle that researchers at Gandhi Peace Foundation and IIT, Delhi, and have been conducting since 1979 (for details, see part II). It is through Dr. Satya that we got to interact with Shoor Vir. In January 1986, following discussions with him on Fukuoka's book One Straw Revolution, Shoor Vir agreed to set aside a certain portion of his farm (out of the approximately 9 acres of land that his family owns) for this experiment. Currently, the area under cultivation using Fukuoka's principles (meaning, not under cultivation!) measures approximately three acres.

Diagram No. 2 (Pg. 44) is a rough map of this three acre piece of land. It lies along the 'kutcha' road from Nangal Jat to Mohanpur, except that the initial corner of approximately 2½ *bigha* (i.e., 0.5 acres, for approximately 5 *bighas* make an acre in the local scale of measurement) belongs to another farmer. Shoor Vir's portion is shown as divided into 3 parts. Part A, measuring approximately 1½ *bighas*, occupies a special place in our experiment. Way back in October 1983, Shoor Vir had set aside this plot for trying our farming techniques without the use of any chemicals. This was a consequence of his feeling, which had accumulated over the many years he had been using modern farming techniques, that chemicals and pesticides are harmful rather than helpful in the long run. The possibility of dispensing with tilling, weeding and composting had not struck him until, in

January 1986, we brought to his notice Fukuoka's book and its application in Hoshangabad at the farms belonging to (i) the Friends Rural Centre, and (ii) Raju Titus. After considering the matter carefully, Shoor Vir agreed to try out this novel, and initially "strange", approach to farming, and chose the 1½ *bighas* we have marked as part A for the first experiment because organic farming had already been practised on this plot for 2½ years.

The experiment based on Fukuoka's principles* was therefore first tried out on Part A of the plot during the rabi season of 1985-86. Mutter and sarson were sown, and the harvesting was done in April 1986. The output was 140 kilograms of mutter and 25 kilos of sarson on this land measuring 1½ *bighas*. This mutter output compared favourably with the neighboring farmers' who had used fertilizers. They averaged 50 to 60 kilo per *bigha*, compared to 90 in our case. But the sarson output was poor by comparison. Perhaps the unseasonal rains that lashed the areas in February- March 1986 was the cause behind this.

After the rabi crop was harvested in April, the straw was returned to this land. In order to cover it completely with a 'blanket' of straw, some straw from the neighbouring sugarcane field was also used. In all subsequent mulchings, this was not found necessary as the straw from the previous crop was found sufficient to form a good blanket. During the

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*This method is generally called 'natural farming', a term that is a literal translation of the Japanese word that Fukuoka uses. But in Japanese, this term has a deeper connotation, because 'natural' is used in the sense of the Tao, the Way or the Universal Law or Spirit which governs the entire universe. In Hindi, the method is often called 'rishi kheti, a term coined by Dr. Partap Agarwal, who pioneered its use while at Rasulia and was responsible for publishing the Indian edition of *The One Straw Revolution*. It is worth noting that the term 'rishi kheti' was also used by Vinobaji, but in a rather different sense. Vinobaji used the term to refer to organic farming with human labour replacing animal labour. Partap Agarwal's rishi kheti is also an extension of organic farming, but in a different direction. The human labour input is considerably reduced rather than increased. Instead, what is demanded from the farmer is a special effort at the level of mind and consciousness whereby he can 'tune in' with Mother Earth and her ecological sensibilities.

summer of 1986-87 there were unseasonal rains. The straw became converted into excellent manure, and Part A became so well covered with grass that it looked like fodder crop had been sown! Once the rains ceased, the greenery on this piece of land wore a sharp contrast to neighbouring areas lying exposed to the sun.

In June 1986, Shoor Vir used up the grass as fodder -- a decision dictated by the needs of the animals rather than the principles of natural farming. He had decided that in July, as the rains start, he would sow the 'dhaan'* crop by the broadcasting method that Fukuoka suggests. But the rains were late in coming. Meanwhile, by the beginning of August, the green covering on the land reappeared, and this time Shoor Vir resisted the temptation to use it as fodder. The rains finally arrived on 16th-17th August, and the dhaan seeds were sown on 18th. But September gain turned out to be a dry month, and it was not possible to compensate for this through irrigation because the tubewell was out of order. Therefore, the Kharif output was poor. But it taught us a lot about the nature of the land. Most important, we realized that the farmer who wishes to practise natural farming needs to give up the tendencies that modern methods inculcate in us, and instead to cultivate a child-mother relationship with the land. Consequently, the rabi season of 1986-87 was devoted to experiments designed to enable a careful study of the land and its behaviour rather than to increasing yields. Some of the interesting observations recorded were:

1. If natural farming is to be practised, then a mix of several seeds has to be sown. This mixture needs to be selected carefully, such that each plant aids the other and the combination approximates the natural ecological balance as closely as possible. For this, indigenous seeds are preferable to hybrid ones.

2. Despite refraining from tilling, the land marked Part

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*Dhaan is a generic term denoting all varieties of paddy. What we city-dwellers generally eat as rice comes from a variety that is known as munji in the Mohanpur area. Munji is a hybrid variety unsuitable for natural farming. The dhaan that Shoor Vir sowed was the traditional variety, which is normally ground and eaten like wheat in Western U.P.

A remained soft and porous. This was a consequence of the activities of various insects such as earthworms and 'makoras'.

3. Not only insects, but birds, bees, spiders, even snakes were beginning to appear on this small patch of land in much larger numbers than the adjoining plots. Therefore, natural farming practices made the land much more 'alive', i.e. teeming with living beings, both at the microscopic level in the soil, as well as at the macro level.

4. The soil was becoming softer and richer as a result of the land becoming more 'alive', with each of the insects and creatures which had made it their home seeming to strike a natural ecological balance and thereby contributing to the fertility of the land.

5. Even the so-called harmful insects seemed to be playing a positive role. For instance, we were rather scared when termites appeared. Would they eat up our plants, the way they reportedly did in the farm of a friend of ours who had embarked on a similar experiment? We kept our fingers crossed, but discovered that the termites eventually proved useful allies, attacking only the cut straw and converting it into useful, soft soil through their excreta, but leaving the crop-bearing plants alone.

6. Similarly, the weeds also did not prove to be an impediment to a healthy crop. Thus, urad was plentiful despite being surrounded by 'chidia badi' and channa did well in the midst of dense layers of 'dhoop'.

7. Many new varieties of weeds and plants automatically made their appearance on this patch of land. Among them are some whose usefulness in herbal medicine is well-recognized by the Ayurvedic practitioners of the area. We are now keeping a register in which samples of these plants are preserved, along with their properties and uses.

Encouraged by the above, we decided in April 1987 to extend our experiment to cover approximately three acres of land. Of this, we could begin implementation of our plans immediately in the area marked Part C in Diagram No.2. In Part B, measuring about six *bighas* (i.e. 1.2 acres), sugarcane had been sown in the previous season, so we decided to leave this portion alone till January 1988 when the sugarcane harvesting would be completed.

In Part B, the following varieties of seeds were sown by the broadcasting method in the kharif season of 1987:

1. Dhaan (not munji, but the variety that gets ground like wheat in Western UP).
2. Urad dal
3. Bajra
4. Samai, a local grain variety that can be eaten as rice, used for porridge, or ground like wheat.
5. Sann, a fibre-producing plant that is also used for making rope.
6. Several other seeds in small quantities, such as arhar, moong, jowar.

The major crop was dhaan, which yielded approximately 1.25 quintals per *bigha*, i.e. 6 quintals per acre. In the Bijnor area, this compares quite favourably with farmers using fertilizers and chemicals and sowing dhaan. If munji is sown the modern way, though, the output can go upto 15 quintals per acre. This is obviously much higher than what we obtained, but when a comparison is being made the following factors should be kept in mind:

1. Our output was a mixed one, unlike that in the usual mono-culture pattern. So, 6 quintals per acre represented only the dhaan portion of the output. Our data gathering process had not been made sufficiently sophisticated at that time to quantify the other ingredients of the output. But we have improved on this now, as will be seen when we discuss the rabi crop results of 1987-88.

2. The figure '15 quintals per acre' (of munji) that the modern farmer gets is applicable only to the lucky farmer in a good season. Because of several variables, some of which are under the control of the farmer but many of which aren't, the average turns out to be much less.

3. The cost of inputs required to produce 15 quintals per acre is quite high. Generally, about two-third of the farmer's revenue gets eaten up by what he has to pay for fertilizers, pesticides, interest rates, etc. Further, as will be discussed in Part II of this report, this input/output ratio is increasing at an alarming rate. Therefore, from the point of view of economics, this higher output of 15 quintals per acre is not really that attractive.

4. The risk factor is also something that needs to be taken into consideration from the farmer's point of view. Despite all precautions that he may take, the risk of a poor harvest is always there. If he opts for modern farming, the inputs become a dead loss in the event of a poor harvest, and the result is often a long-term burden on his family because of the village loan system that the farmer is forced to become a part of. If these inputs can be avoided, as is possible through natural farming, even a very poor harvest is easier to live with.

There are also many non-quantifiable benefits of natural farming, which do not come through easily when the output figures are being compared. For instance:

1. The quality of the output we obtained was excellent, especially in dhaan, and urad. All the neighbouring farmers were unanimous in their evaluation in this regard.

2. The sann crop was very good not only in terms of quality but also in terms of quantity, and for a very interesting reason. Sann is a plant that can grow pretty tall, but normally the farmer cuts it long before it has grown to its full height because the land has to be cleared for the sowing of the rabi crop. In our case, because no tilling was required, we could harvest the dhaan, put its straw back as mulch, and sow the wheat crop for the rabi season, leaving the sann plants still standing. So, in October-November 1987, there was on our farm what seemed a "strange" sight to all the residents of the area: a sann crop, belonging to the kharif season, growing taller and taller in the midst of fresh shoots of wheat, belonging to the rabi season!

3. Another "strange" phenomenon we recorded was the appearance, especially in Part A, of plants whose seeds we had not sown! For instance, many jowar plants appeared in areas where we had not planted them. Obviously, because the land had not been tilled, the roots from the previous year's jowar crop had remained in the soil and was now yielding new plants.

Diagram No. 3 (Pg. 45) shows the rabi crop sowing pattern that we followed. Part A of the land was deliberately left out of those experiments where we measured yields, and was instead allowed to develop a natural, "wild" pattern of its own so that we may study the effect of leaving the land to

itself on the condition of the soil. Part C was divided into six zones as shown, and the following combinations of seeds were sown:

Plot No.	Area in Acres	Seeds Sown 1		2		3		4	
1	0.4	Wheat	20 kg	Masoor	6 kg	Sarson	1 kg	Sonf	400 gms
2	0.2	Wheat	5 kg	Jow	5 kg	Chhanna	5 kg	Sarson	500 gms
3	0.15	Chann	+	Mu	6.5 kg	Sarson	200 gm	Alsi	200 gms
4	0.25	Masoor	5 kg	Sarson	600 gms	Tari	125 gms	Alsi	300 gms
5	0.25	Wheat	11 kg	Sarson	625 gms				
6	0.15	Barseen	1.25 kg	Sarson	400 gms	Jow	1.5kg	Sugarcane	4 piecess

The principal objective of this rabi crop pattern was to study the effectiveness and desirability of each combination. We were trying to figure out how well these plants supported and supplemented each other, and also how the land reacted to each of these seed varieties. Unfortunately, despite our best efforts, we were unable to procure indigenous seed varieties for wheat, and so had to be content with the hybrid ones. But in the case of all the others, the seeds that we planted were the indigenous varieties.

In January 1988, the sugarcane harvesting was completed and so we were able to incorporate the land marked as Part B into our experiment. We decided to sow the summer crops ('jayad fasal') on it. But first, the land had to be cleared of sugarcane stubs, and so a light tilling had to be done. Having completed that, we divided Part B into three zones as shown in Diagram No.4 (Pg. 46) and planted the following seeds:

Plot No.	Area in acres	Seeds Sown 1	2	3
7	0.25	Sunflower	Sann	Urad
8	0.25	Corn	Bajra	Urad
9	0.5	Sunflower	Moong	Urad

In March/April 1988, the rabi crop was harvested. The results are shown in Table 1 (Pg. 26-27). As can be seen, this time the data gathered has been more detailed and systematic. It is no easy task to collect and record these figures in farming situations, as we have learnt at the cost of much pain and labour!

Table 1

1987-88 Rabi Results at a Glance

Plot No. 1	*Seeds Sown*		*Output*	*Income* Rs.	*Important lessons/observations*
	Wheat	20 kg.	66 kg.	132	1. Wheat of the hybrid variety seems unsuitable for natural farming.
Area: 0.4 acres	Masoor	6 kg.	140 kg.	700	2. Masoor had to be harvested 10-15 days before wheat was ready, resulting in damage to the latter.
Water input: 20 hours	Sarson	1 kg.	14 kg.	112	3. The irrigation and soil moisture requirements for sarson and sonf seem to be in conflict with that for wheat.
Labour input: 14 mandays	Sonf	400 gms	Negligible	—	4. In view of the above, the combination of wheat, masoor, sarson and sonf does not seem a suitable one.
			Total	944	
Plot No. 2	Wheat	5 kg.	90 kg. (mixed)	180	1. Except for sarson, which experienced lack of water, the combination seems fine.
Area: 0.2 acres	Jow	5 kg.			
	Channa	5 kg.			
Water input: 6 hours				40	
Labour input: 4 mandays	Sarson	500 gms	5 kg. (biomass 200 kg.)	—	2. More seeds should have been broadcast.
				220	

Plot No. 3 Area: 0.15 acres Water input: 2 hours Labour input: 4 mandays	Channa / Mutter	6.5 kg.	56 kg.	336	1. More seeds should have been broadcast. 2. Many weeds appeared; but the crops flourished in their midst. 3. The combination seems okay—there were no problems.
	Sarson	200 gms	4 kg.	32	
	Alsi	200 gms	Negligible		
				368	
Plot No. 4 Area: 0.25 acres Water input: 8 hours Labour input: 6 man-days	Masoor	5 kg.	125 kg.	625	1. Good combination. The masoor crop was specially good. The weeds and grasses did not affect it adversely at all.
	Sarson	600 gms	5 kg.	40	
	Tari	125 gms	375 gms	4	
	Alsi	300 gms	600 gms [+ biomass of approx. 200 kg.]	6	
				675	
Plot No. 5 Area: 0.25 acres Water input: 16 hours Labour input: 4 man days	Wheat	11 kg.	34 kg.	68	1. The mutter output, obviously a 'carry over' from the previous crops, is remarkable. 2. The combination seems fine. 3. As in Plot No. 1, the wheat yield was poor.
	Sarson	625 gms	5 kg.	40	
			+ Mutter (without sowing) — 25 kg.	125	
				233	
Plot No. 6 Area: 0.15 acres Water input: 8 hours Labour input: 2 man-days	Barseen	1.25 kg.	10 to 11 quintals of fodder		1. Natural farming seems well suited for fodder. 2. The experiment with sugarcane is being watched with interest. So far, the plants are surviving, though not very strong.
	Sarson	400 gms			
	Jow	1.5 kg.			
	Sugarcane	4 pieces			

This rabi crop has been very helpful to us in our learning process and in formulating plans for the future. Some of the important points it has taught us are:

1. Wheat, particularly of the hybrid variety, does not seem too suitable for natural farming. We have re-doubled our efforts to locate seeds of the indigenous type, and some of what we have found in the nearby hill areas where rainfall is scarce looks promising. We intend to try these out in the next rabi season.

2. The quantity of seeds sown should be considerably higher in the case of natural farming than in modern or organic farming. The extra expense involved is well worth it, considering the savings in other inputs such as fertilizers.

3. Some combination of seeds work well because they support each other, while other combinations are not so good. For instance, masoor seemed to go very well with sarson, tari and alsi, but not with wheat, because the latter got damaged when masoor, which gets ready 10-15 days prior to wheat, was being harvested.

4. By and large, the results were quite encouraging in terms of quantity as well as quality, keeping alive our hopes of making natural farming a viable alternative. Neither the weeds nor the insects and so-called pests (such as rats) proved a problem. There was an increase in the number of birds and animals, with the appearance of new ones such as deer, dogs and `nevla'. The soil conditions, especially in Part A, showed considerable improvement

Making use of the rabi results, we are now in the process of finalizing the seed pattern for the kharif crop to be planted in June/July. In Part A, we are continuing the earlier policy of sowing a vast variety of seeds, more with the idea of learning their mutual interaction rather than to obtain harvest. Already, we can see that the soil conditions and the ecology in this portion have undergone tremendous improvement: if regular farming were to be done here, Shoor Vir is confident of a bumper crop. But our idea is not to increase yield but to further improve the soil and watch the development of its ecology. During the coming season, we plan to sprinkle on this land a mixture of all possible kharif seeds, and also plant a variety of fruit trees - papaya, lime, guava, 'ber' and 'karonda'.

Part B already has the seeds sown in February, and on Part C we are planning six different combinations. Each combination has been selected by Shoor Vir on the basis of the following criteria:

1. One 'principal' seed, on which our harvesting interests will be centred. The six seed varieties selected in this category are (a) arhar, (b) cotton, (c) moong, (d) samai, (e) urad, and (f) dhaan. This is the first time we are trying out cotton, which is not normally grown in the Bijnor area because the soil is not soft enough. But with the soil conditions improving on our land, could it be that it can support a cotton crop?

2. One or more 'support' seeds, chosen in such a way that they complement rather than compete with the principal one. A major criterion for determining this is the shape, height, depth and nutrient requirements of the plants. As far as possible, a variety in each of these characteristics is selected. Thus, there is variation in the height of the plants, and so also in the depth to which their roots reach. For instance, where samai has been selected as the principal crop, we have also introduced jowar, bajra and arhar, because the roots of the samai plant penetrate only into the top soil, whereas jowar and bajra go upto medium depth and arhar goes quite deep. In some cases, criteria other than plant height and depth have also played a role. For example, samai has been selected as one of the support seeds in the area where arhar is the principal seed. The reason is that the samai crop is ready in 70 days, approximately the same time it takes arhar (and also urad, another of the support seeds selected for this area) to flower. So, when the farmer goes in to harvest the samai crop, his presence there will be aiding rather than obstructing the other plants' growth, for he will act as an agent for pollination (unlike in the masoor-wheat combination during the rabi season where the farmer's presence during the masoor harvesting harmed the wheat crop). Similarly, in the area where cotton has been chosen as the principal seed, moong is being sown as a support because of its nitrogen fixation qualities, which should help to keep the soil moist.

3. A set of 'protective' seeds, whose job is to save the principal and supportive plants from insects and other dangers. For instance, jowar and bajra seeds have been sown

in small quantities in every plot. Their plants, taller than the other ones, will attract the birds. Birds will therefore be present on the land, but their main attraction will not be our principal crop. And they will also help keep the insect population down.

4. A set of 'test' seeds, sown in small quantities. These seeds are new to the area, and the idea is to check how well the land responds to these new varieties. A good example is 'ragi', a seed brought by us from the South. It seems similar to 'samai' which grows well in this region, and the object of our experiment is: Will ragi grow well too?

Diagram No.5 (Pg. 47) shows the distribution of seeds selected for the coming kharif crop. As is obvious, the multi-cropping pattern recommended by Fukuoka is much more in evidence this time than in any of our previous trials. In no case are there less than 6 seed varieties, and in Plot No.2 we have as many as 11 of them. Therefore, the results of this kharif crop would be very interesting to watch. We hope to have all data in by November-December 1988, after which we will prepare our next report.

The ultimate goal of farming is not the growing of crops but the cultivation and perfection of human beings. Natural farming is a combination of science and philosophy. For the last 50 years, I have called it the Gandhi method. The inspiration for this I received from the teachings of Buddha.

Masanobu Fukuoka

Author of *One Straw Revolution* and *The Natural Way of Farming: The Theory and Practice of Green Philosophy*, Winner of Magsaysay Award, 1988

Part II: The Background

The genesis of this experiment in natural farming goes back to the years 1977-79, when a few researchers at GPF and IIT, Delhi, began to meet regularly to discuss "alternatives" to modern forms of development. Interest in these alternatives arose because of a disillusionment with existing answers to the basic questions concerning our existence. At that time, while we were clear about our disillusionments, we were groping in the dark as far as any viable alternative was concerned. But the questions that we were addressing ourselves to seemed interesting and challenging, and so we began to meet regularly in an informal Study Circle.

Most members of this Study Circle were from the science and technology streams and so one question that particularly engaged our attention was the role that science and technology should play in any alternative to modern forms of development. While engrossed in this question, we came across Fritjof Capra's *The Tao of Physics*. This book seemed to point out a new world-view that 20th century science, starting with the theory of Relativity and Quantum Mechanics, was indicating - a holistic rather than reductionistic view where the universe, instead of being viewed as consisting of discrete, atomized units, was beginning to be seen as a unified, interconnected whole. It struck us that this view of the universe could provide the theoretical foundations of a Gandhian or ecological approach to our problems in much the same way as 19th century science did for a Marxist or materialist approach.

We were pleasantly surprised to discover that Capra's book was not the only one to espouse this newly emerging world-view in science. Within a few years, we came across an avalanche of new books that dealt with this interesting subject, some of them by well-known scientists such as David Bohm (a close associate of Einstein), Illya Prigogine (the Nobel laureate in chemistry) and Arthur Young (inventor of the Bell helicopter). Here is a partial list of some of the books that helped us to understand what this 'new science' may have in store.

Title	*Author*
THE TAO OF PHYSICS	Fritjof Capra
THE DANCING WU LI MASTERS	Gary Zukov
WHOLENESS AND THE IMPLICATE ORDER	David Bohm
THE REFLEXIVE UNIVERSE	Arthur Young
SPACE, TIME AND BEYOND	Bob Toben
THE MECHANICS OF ENLIGHTENMENT	Anthony Campbell
FROM BEING TO BECOMING	Illya Prigogine
SOME THOUGHTS ON SCIENCE AND RELIGION	D.S. Kothari
THE GEOMETRY OF MEANING	Arthur Young
THE STRUCTURE OF SCIENTIFIC REVOLUTIONS	Thomas Kuhn
THE MEANING OF RELATIVITY	Albert Einstein
PERSONAL KNOWLEDGE	Michael Polanyi
TAKING THE QUANTUM LEAP	Fred Alan Wolf
VEDIC MATHEMATICS	Jagadguru Swami Bharti Krishna Tirtha
INFINITY AND THE MIND	Rudy Rucker
GODEL, ESCHER AND BACH	Douglas Hoffstadter
ORDER OUT OF CHAOS	Illya Prigogine
LOOKING GLASS UNIVERSE	Peat & Briggs

The last book in this list, *Looking Glass Universe*, gives a wonderful overview of these new developments in science by invoking Lewis Carroll's Alice and her looking glass to explain the implications of these theories. The authors, Peat and Briggs, use a powerful analogy to drive home their point:

> Science and its sister, technology, are full of surprises - so many surprises it's difficult to be surprised anymore. Black holes, genetic engineering, dust-sized computer chips - what next? We're ready for anything. The theories and artifacts of science have long since become firmly established on our landscape, spreading and changing like a city's skyline. We've all become inhabitants in this city. Around us new structures rise, redevelopment projects take place as discoveries come and go. We take it in, rather jaded by this fast-paced and dazzling environment.
>
> But lately, faintly, there has been a rumbling of the ground, a change in the light: mysterious signs. Strange

reports reach us from people who have been working beneath the ground, in the deepest structures of the city, that they may have uncovered something, stirred something which could drastically change the city and all who inhabit it. We have called the theoreticians who bring us these reports scientists of the looking glass. They have a deep surprise in store for us, they say deep, because it is a surprise at the very foundations of science.

Peats and Briggs have sub-titled their book "the new revolution in physics, mathematics, chemistry, biology and neurophysiology", and in it they cover the work of four leading, well-known scientists -David Bohm the physicist, Illya Prigogine the chemist, Rupert Sheldrake the biologist, and Karl Pribram the neurophysiologist. As this list indicates, these new ideas are now percolating into the application sciences as well. Our Study Circle has been really amazed as to how innovative ideas appearing in the different sciences have been dovetailing beautifully with each other to give a wonderful pattern to the newly emerging world-view. Often, the origin of these ideas is far removed from the theoretical developments relating to quantum and relativity theories, and yet a deeper examination reveals a definite connection. For example, the `clinical death' studies of the medical science researchers Elizabeth Kubler-Ross, Kenneth Ring, Raymond Moody and Michael Sabom, are the result of work on medical patients, but their conclusions on the nature of human consciousness is very closely tied up with Einstein's notions of space and time, a point Kenneth Ring has dealt with in invoking Karl Pribram's `holographic' paradigm to explain the functioning of the human brain.

Similarly, there has been a resurgence of new ideas in some areas of technology, particularly agriculture and medicine, and also in the social sciences, whose link with the newly emerging world-view of 20th century science captured the interest of our

Study Circle: We have so far collected more than 200 books dealing with these ideas, and also subscribe to a set of journals that espouse these views. Some examples of these books and journals are:

Books containing new ideas pertaining to the social sciences and to social change.

Title	*Author*
A GUIDE FOR THE PERPLEXED	E.F. Schumacher
THE AQUARIAN CONSPIRACY	Marlyn Ferguson
VOLUNTARY SIMPLICITY	Duane Elgin
THE MARRIAGE OF EAST AND WEST	Bede Griffiths
THE HUMAN CONDITION	Hannah Arendt
THE HUNDREDTH MONKEY	Ken Keyes
ENTROPY	Jeremy Rifki
DEBT SHOCK	Darrell Delamaide
THE TURNING POINT	Fritjof Capra
HEADING TOWARDS OMEGA	Kenneth Ring
A GANDHIAN THEOLOGY OF LIBERATION	Fr.Ignatius Jesudasan

Books containing new ideas pertaining to the life sciences

Titles	*Author*
A NEW SCIENCE OF LIFE	Rupert Sheldrake
THE HOLOGRAPHIC PARADIGM	Karl Pribram/Ken Wilber
THE ROOTS OF CONSCIOUSNESS	Jeffrey Mishlove
LIFE AT DEATH	Kenneth Ring
SCIENCE, ANIMALS AND EVOLUTION	Catherine Roberts
LIVING TIME	Maurice Nicoll
THE NEW MAN	Maurice Nicoll
THE PSYCHOLOGY OF CONSCIOUSNESS	Robert Ornstein
THE HUMAN MYSTERY	John Eccles
THE BODY ELECTRIC	Thelma Moss
LIVING SYSTEMS	James Miller
THE NEW BIOLOGY	Augros and Stanciu
THE SECOND MEDICAL REVOLUTION	Foss and Rothenberg

Books containing new ideas pertaining to technologies

Titles	*Author*
THE ONE STRAW REVOLUTION	Masanobu Fukuoka
THE NATURAL WAY OF FARMING	Masanobu Fukuoka
SMALL IS POSSIBLE	George McRobie
HANDBOOK OF HOMEMADE POWER	Compiled by Mother Earth News

FOREST FARMING	Douglas & Hart
SOFT ENERGY PATHS	Amory Lovins
HUMAN SCALE	Kirkpatrick Sale
LAUREL'S KITCHEN	Robertson, Flinders & Godfrey
DIET FOR A SMALL PLANET	Frances Moore Lappe

Journals

Manas	*East West Journal*
Re-Vision	*New Age*
Resurgence	*Gandhi Marg*
Pendle Hill Pamphlets	*Brain/Mind Bulletin*

The experiment at Mohanpur is a direct result of our exposure to the ideas contained in the above books and journals, particularly to Masanobu Fukuoka's books *One Straw Revolution* and The *Natural Way of Farming*. We first came across *One Straw Revolution* in 1985, when the Indian edition of the book was published by Shri Partap Agarwal at the Friends Rural Centre in Rasulia, Madhya Pradesh, were Shri Agarwal was guiding an experiment along the lines that Fukuoka had recommended.

We were fascinated by this book, for it seemed to suggest an answer to a basic question that had bothered us since the inception of our Study Circle: What place should technology occupy in the alternative vision? Fukuoka's book showed us that we were asking the wrong question. We were bothered about the place of technology because on the one hand we had become aware of its ill-effects, but on the other hand were loath to abandon it because we did not wish to deprive humanity of material benefits. But Fukuoka's book and Partap Agarwal's experiment at Rasulia opened our eyes to a new way of looking at this question, namely, are there techniques by which we can meet our material needs by being *in tune* with nature rather than trying to conquer nature?

In other words, can't we replace our present technologies, which are anti-ecological in character, by new methods (if we wish, we could even retain the word 'technology') which enhance the ecology of the earth and yet give us our material requirements? Fukuoka's thesis is based on the faith that *we can* do so, that if only we respect Mother Earth and care for her, she is only too willing to shower her bounties on us.

Such a faith is in consonance with he holistic world-view that is emerging in the new developments in science that we have been studying, and therefore Fukuoka's books fitted in very well with the 'alternative' scenario that was engaging our attention.

Mahatma Gandhi had actually predicted the emergence of such new methods/technologies long ago. In a powerful but little noticed statement of his, he had said:

> Modern science is replete with illustrations of the seemingly impossible having become possible within living memory. But the victories of physical science would be nothing against the victory of the Science of Life, which is summed up in Love which is the Law of our Being.

In order words, Gandhi predicted the emergence of more wonderful technologies (if we may use that word) when we human beings develop not just our analytical abilities as at present but also those spiritual faculties latent in each one of us that make us understand *the* law that governs the entire universe, and is the fountainhead of all other laws. This basic, fundamental law that unifies everything, he termed, 'the Science of Life, which is summed up in Love, which is the Law of our Being.' Gandhi emphasized that this Law *cannot* be grasped at the level of the intellect. It requires the development of higher faculties latent in each one of us. This is precisely the origin of Fukuoka's 'natural farming'. At the age of 25, he had what in Japanese Buddhist terminology is called a 'Mu' experience (perhaps the Indian equivalent is '*sunyata*' ,*i.e.* 'nothingness'), wherein he was able to *see* (rather than just intellectually understand) that unity which binds everything in the universe. He could thus view the earth as a living entity ('Gaia' or 'Mathrubhoomi') and the soil as the sacred entity which sustains us. His method or technology of 'natural farming' is a direct outcome of such an experience.

There are fundamental differences between technologies arrived at with the help of the intellect and those arrived at through development of the higher faculties. The first may be likened to swimming from one shore to the other by preselecting points based on the 'shortest route' but on the assumption that waves on the way have to be battled and conquered, and the second to negotiating the journey by

swimming along with the waves, allowing full flexibility in terms of the route and the end point. The former may seem efficient, but the effort involved in battling the waves can often have disastrous consequences; the latter may seem inefficient and illogical, but may prove the wisest course.

Gandhi recognised the efficiency and worth of science and technology based on the intellect by crediting it with 'illustrations of the seemingly impossible having become possible within living memory'. But he also warned that the atrophied world-view on which such science and technology are based would lead to an ever-escalating spiral of crises. Every 'technological fix' to a problem would ultimately lead to a new set of problems. This is precisely what is beginning to become evident now, and is a consequence of our battling the waves of nature. Wherever modern development processes have been adopted, we are slowly witnessing the emergence of seemingly insoluble crises. For instance, on the agricultural front, even though technologies to increase food production have been very high on our list of priorities, hunger and malnutrition are as widespread as ever. We are now making massive new investments in this field so that food production figures may be further increased, but in the process are being confronted with new problems which thwart our basic objectives. To mention a few of the new trends that defy our attempts to end hunger and malnutrition through modern agricultural practices:

1. Every season, huge piles of essential food items sometimes potatoes, sometimes cauliflower, sometimes sugarcane, sometimes apples, sometimes butter - are deliberately and systematically destroyed through poisoning or burning even though at that very moment, millions re dying of starvation. Why does such a terribly paradoxical situation arise? It is not just a question of greed on the part of the food growers, it is also a question of where and how the food is being produced. Modern agricultural technology had resulted in monoculture; and the wilful destruction of valuable crops is a direct result of this. Huge stocks build up in one area, but the demand for that particular item is in an entirely different area. Thus, while modern farming technologies may have increased yields, they have also brought about situations forcing the destruction of yields.

2. The cost of inputs has been skyrocketing, but their effectiveness diminishing. For example, Graph No.1 (Pg. 42) shows how the cost of developing a new pesticide has shot up nearly 40 times between 1956 and 1984. The price the consumer has to pay for it has risen even more sharply - e.g., one kilogram of DDT used to cost only 40 cents in the USA in the 1950s and 1960s, but the new pesticides are being sold at rates ranging from $90 to $900, a kilo. The situation is even worse in countries like India, for the know-how has to be imported and we are at the mercy of the multinationals and others who own the patents.

3. One may conclude that he higher costs of newly developed inputs means better effectiveness, for they represent more advanced technologies. But in many cases the fact of the matter is *just the opposite*. This paradox is evident from Graph No. 2 (Pg. 42) which shows the number of insect species that have become *resistant* to our pesticides. In 1935, only seven insect species refused to run away or die when chemicals were sprayed, but by 1986, despite the development of far more potent and poisonous pesticides, this number has gone up to 462. It is evident that as we are engaged in research aimed at discovering more powerful pesticides, the insects are not meekly submitting to extinction but have been furiously engaged in research of their own to discover ways and means of survival. Thus, unlike in the case of cars or satellites or computers, our 'advanced' technologies in agricultural represent a game wit other *living* organisms, which often emerge victorious in the long run. We, therefore, get caught up in an ever-increasing spiral of new and costlier technologies merely to offset the diminishing effectiveness of the earlier ones.

4. Excessive erosion of top soil as a result of our anti-ecological practices in modern farming also poses a grave threat to land productivity. The earth's top soil is a sacred and special endowment from nature to us. Instead of preserving and building on this endowment, we are depleting it in the name of 'higher output' from land. In some areas of the world where modern farming techniques have been used more intensively, the first signs of desertification are already beginning to appear.

5. Wherever modern farming technologies have been introduced, there has been an alarming fall in the ground

water level. For example, in that portion of Bijnor district which forms the site of our experiment, the water level was between 10 and 15 ft. in 1970. But, since then, with the introduction of modern technologies to enable large-scale sugarcane cultivation, the level has dropped continuously, and now stands at 42 ft.

6. While the quantity of food production may have gone up as a result of modern technologies, the quality has definitely gone down. The use of pesticides and chemicals is adversely affecting human health and well being.

7. The economics of farming is undergoing major changes, with small and medium-sized farmlands becoming totally uneconomical. In India, even a 10 acre farm is now insufficient to sustain a nuclear family of four or five members. In countries like the USA, farmers holding 200 to 500 acres of land are finding themselves forced to declare bankruptcy. Literally millions of farmers the world over are finding it difficult to make both ends meet.

It is in the context of the above problems that Fukuoka's method assumes special significance. At a time when the world of agriculture is in the throes of a major dilemma - to get away from modern farming seems disastrous, but continuing with it seems even more so - Fukuoka suggests a novel way out. This suggestion emanates from his insight that modern civilization's promise to make life easier for us by fighting against and subduing nature is false. His spiritual experience revealed to him the love and unity that is at the core of all existence. Translated into the world of agriculture, it means that the soil and the earth *want* to serve us, if only we will let them. They are like a mother to us. So, our effort should be to enrich the soil and to enhance the ecology of the earth. When we act thus and are in tune with nature and the law ('Tao') that governs the universe, there is nothing more to be done, no need to disturb the natural ecological processes - hence his method is also called 'do nothing' farming. No need to put fertilizer or chemicals, no need even to till or weed. Thus, the four basic principles enunciated by Fukuoka are in the form of four 'Nos', as follows:

1. No cultivation, that is, no ploughing or turning of the soil. For centuries, farmers have assumed that the plough is essential for growing crops. However, non-cultivation is

fundamental to natural farming. The earth cultivates itself naturally by means of the penetration of plant roots and the activity of micro-organisms, small animals and earthworms.

2. No chemical fertilizer or prepared compost. If left to itself, the soil maintains its fertility naturally by developing an ecological balance in accordance with the orderly cycle of plant and animal life. Artificial efforts to increase productivity create wounds in the soil which ultimately drain away essential nutrients and deplete the fertility.

3. No weeding by tillage or herbicide. Weeds play their part in building soil fertility and in balancing the biological community. As a fundamental principle, weeds should be controlled, not eliminated. Making a mulch using straw, providing a ground cover of white clover, and temporary flooding are examples of how this controlling can be accomplished.

4. No dependence on chemicals or pesticides. Nature, left alone, is in perfect balance. Harmful insects and plant diseases are always present, but do not occur in nature to an extent which requires the use of poisonous chemicals. The sensible approach to disease and insect control is to grow sturdy crops in a healthy environment.

Within the confines of his four principles, Fukuoka encourages innovation and creativity. There are no standard 'procedures' for natural farming. Each farmer has to build up his own relationship with his piece of land, and learn to be creative. Like in any mother-child relationship, there can only be broad guidelines and principles, no set rules.

If Fukuoka's method really works, it opens up very exciting possibilities not only in the world of agriculture, but for humanity in general. In a sense, it confirms the power of 'the Science of Life which is summed up in Love which is the Law of our Being' that Gandhi referred to. Therefore, we who had formed the Study Circle were very eager to try it out, and pleased when Shoor Vir Singh agreed to do so on his farm. Shoor Vir and his associates Rajinder, Sonath Pradhan and Atul have been at the task for more than 2 ½ years now. This is too short a period to reach any conclusions in the world of agriculture, but the initial trends are definitely encouraging.

All Nature is but Art
unknown to thee
All Chance, Direction
which thou cannot see
All discord, Harmony
by thee not understood

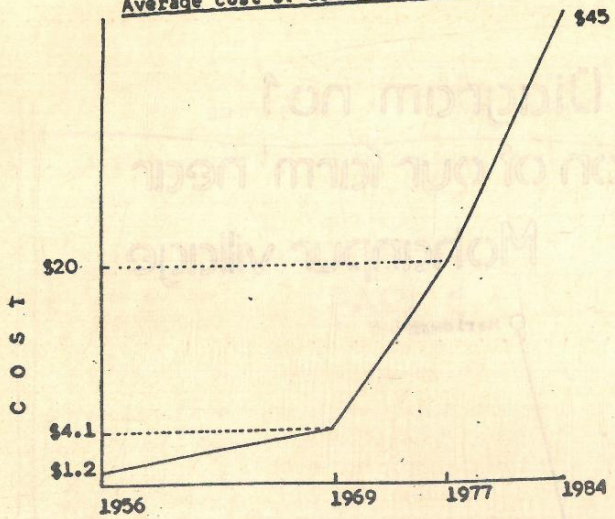
Alexander Pope

Where is the life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?
The cycle of heaven in twenty centuries
Has brought us farther from God
And nearer to the dust.

T.S. Eliot

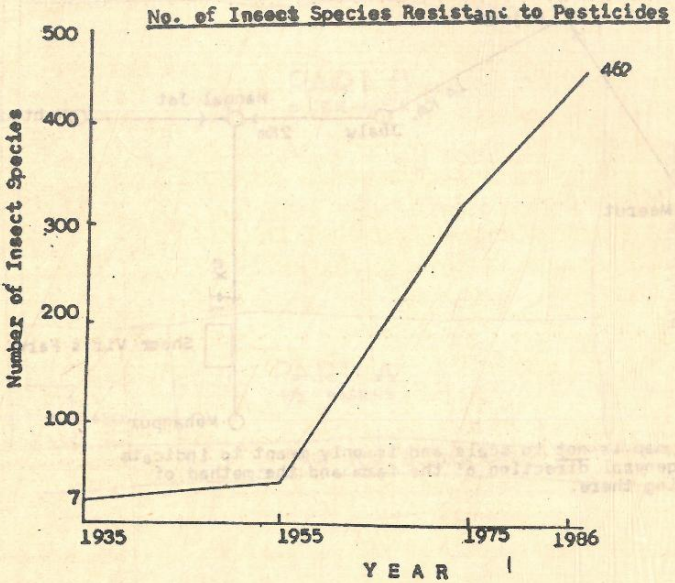
G R A P H NO.1

Average cost of developing a new Pesticide (Million Dollars)



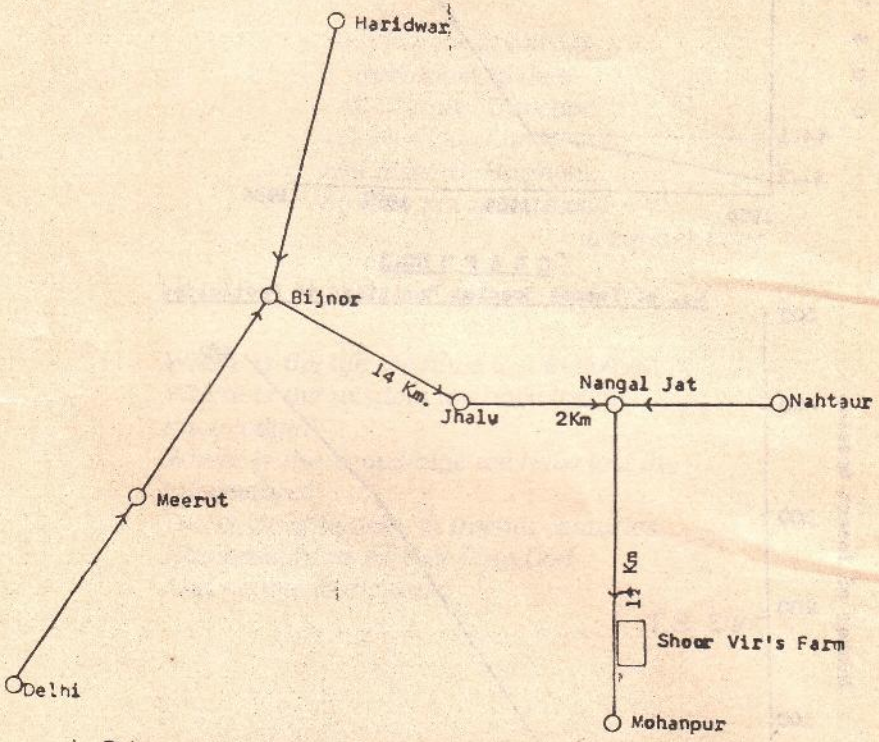
G R A P H NO.2

No. of Insect Species Resistant to Pesticides



Source: U.S.News and World Report, Oct. 13, 1986.

Diagram no 1
Location of our farm near Mohanpur village



This map is not to scale and is only meant to indicate the general direction of the farm and the method of getting there.

Diagram no. 2

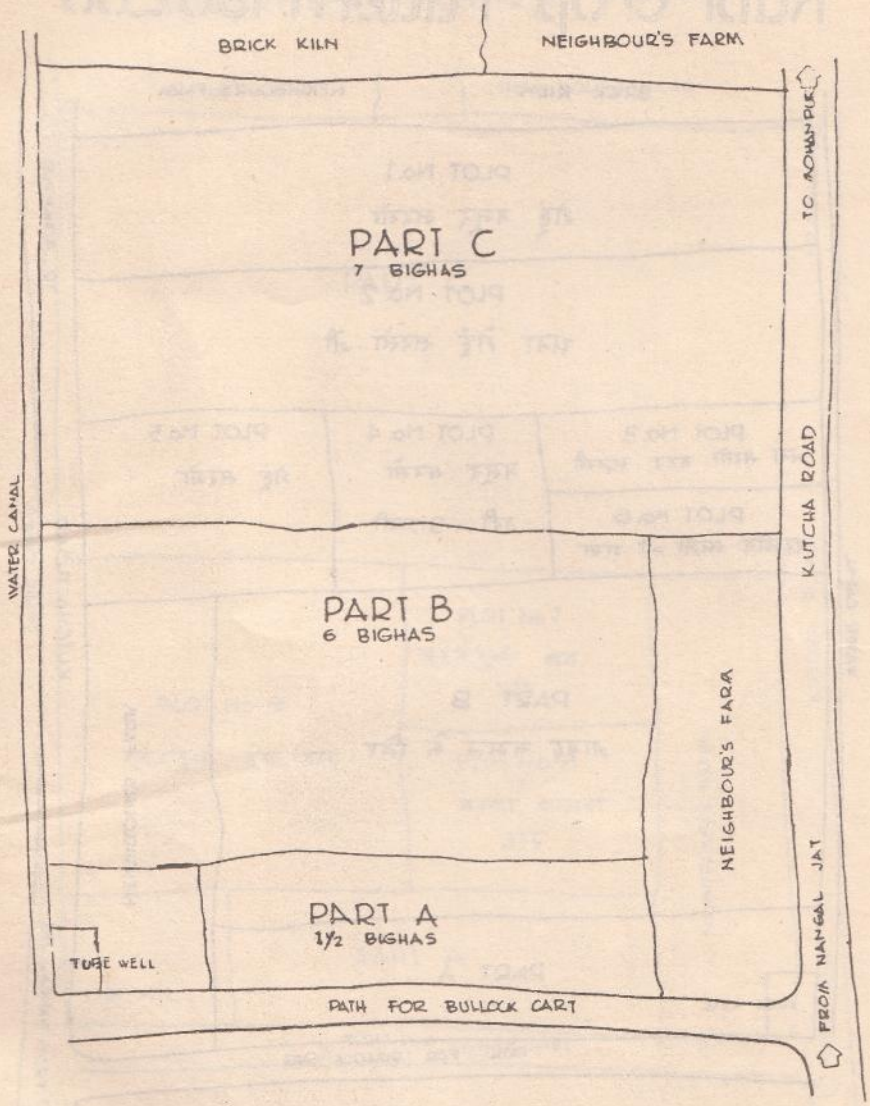

BRICK KILN
NEIGHBOUR'S FARM
TO ROHANPUR
PART C
7 BIGHAS
WATER CANAL
KUTCHA ROAD
PART B
6 BIGHAS
NEIGHBOUR'S FARM
PART A
1½ BIGHAS
TUBE WELL
PATH FOR BULLOCK CART
FROM NANGAL JAT

Diagram no. 3
Rabi Crop Pattern 1987-88

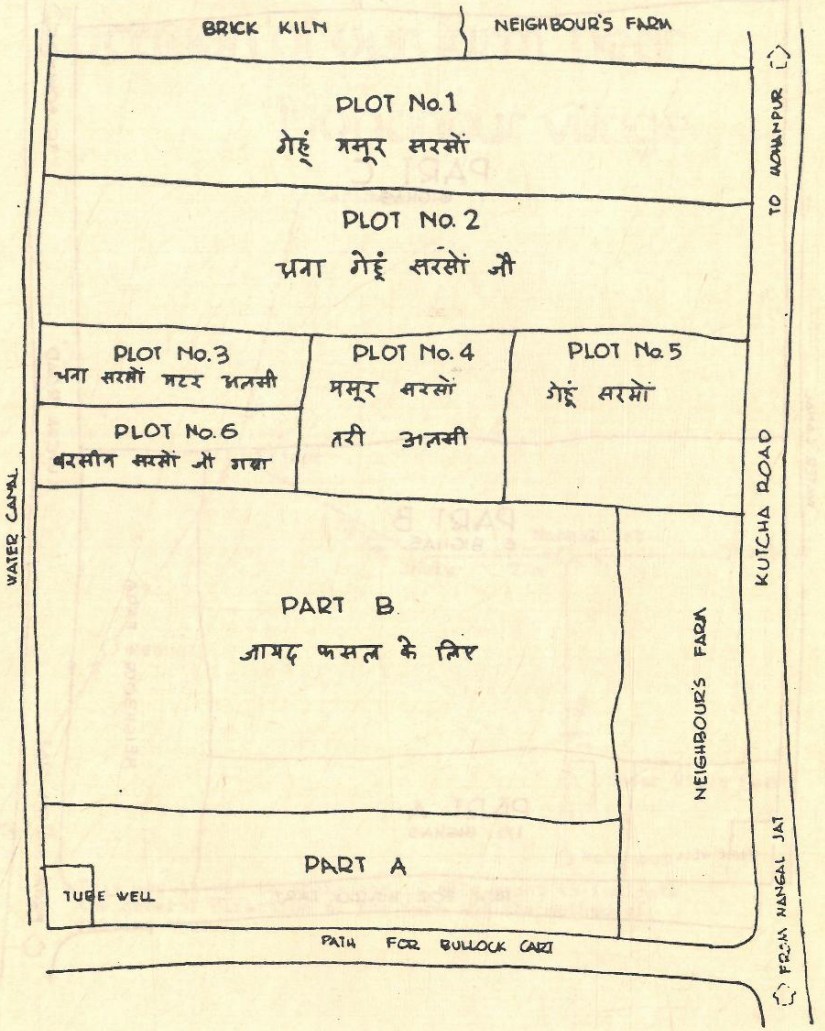


Diagram no. 4
Summer Crop 1988

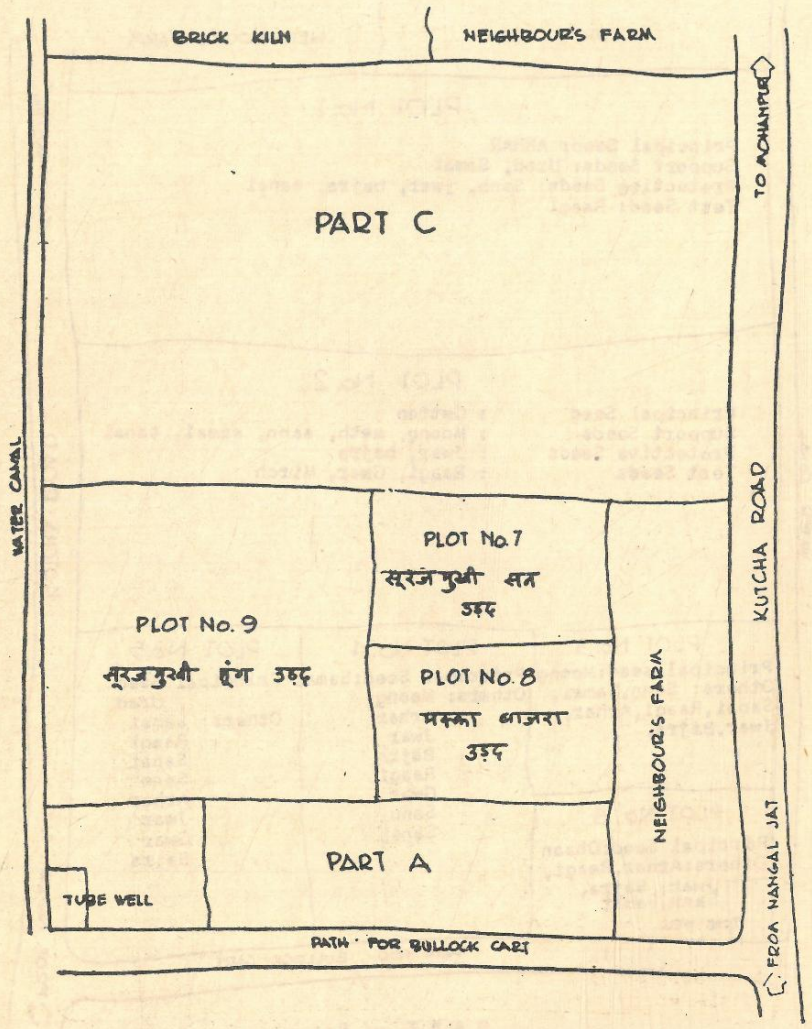
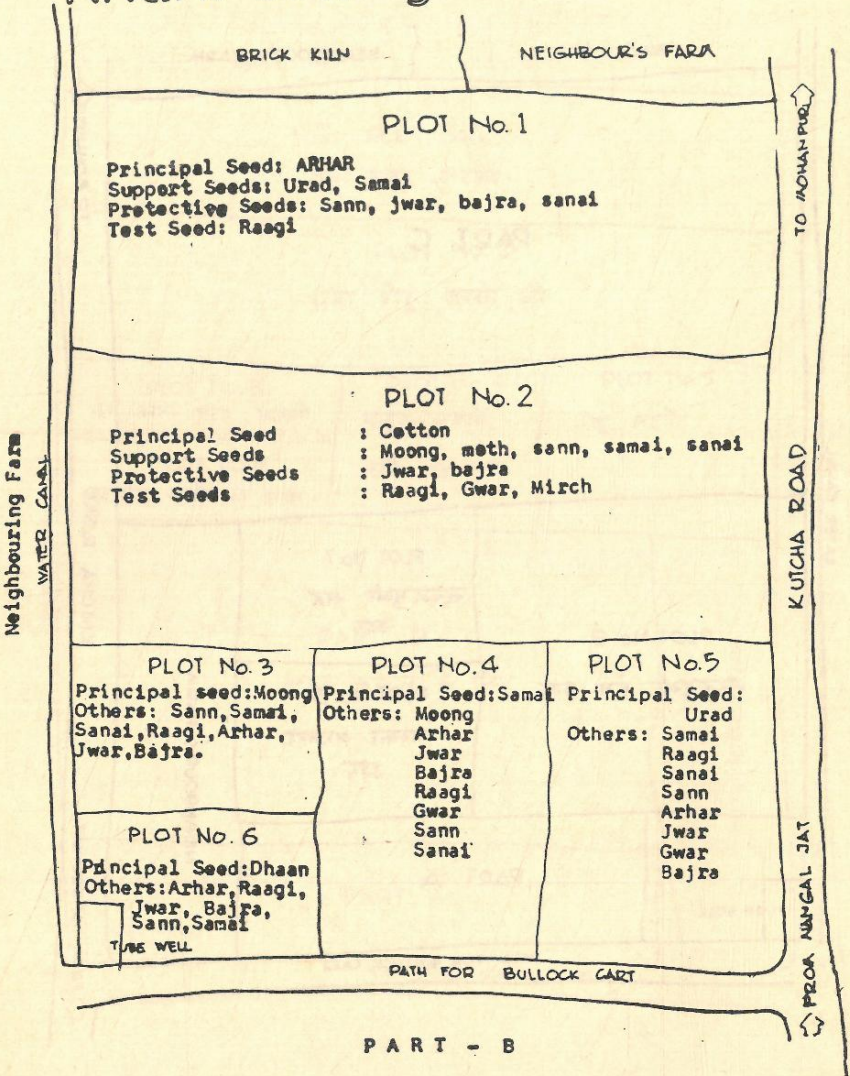


Diagram no.5

Kharif sowing 1983. Part_C



PART - B