

Nature Farming Research and Development at the Naturfarm in Lompoc, California, USA

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Abstract

The Naturfarm is located near Lompoc, California and comprises about 75 tillable acres of cropland. The farm was acquired in 1988 to demonstrate the feasibility of large-scale, commercial vegetable production in the United States using nature farming methods and a permanent-bed planting system. It is certified as an organic farm by the California Certified Organic Farmers Association (CCOF). The Naturfarm is supported by Sekai Kyusei Kyo, Atami, Japan and managed by the Nature Farming Research and Development Foundation (NFRDF) to promote the development and feasibility of Kyusei Nature Farming and EM technology through research, education and outreach programs. The Naturfarm also produces organically-grown vegetables for Johrei Centers and for local and regional markets. Management strategies at the Naturfarm focus primarily on the integration of non-chemical methods to maintain adequate soil quality and to control harmful insects and weeds while achieving optimum crop yields and quality.

Introduction

In 1980, the U.S. Department of Agriculture issued its widely-read and often-quoted “Report and Recommendations on Organic Farming” (USDA, 1980). The Report concluded that there were growing concerns among farmers, consumers, environmentalists, and society in general about the adverse effects of chemical fertilizers and pesticides on a) human and animal health, b) environmental quality and biodiversity, and c) food safety and quality.

Because of increasing evidence which tended to substantiate these concerns, the USDA Report urgently recommended that U.S. agricultural research agencies seek to develop new and improved techniques for controlling weeds, insects and plant diseases using non-chemical methods, with particular emphasis on biocontrol methods using natural predators and parasitic insects. Organic recycling of crop residues, green manures, animal manures and composts were recommended to maintain soil productivity in lieu of chemical fertilizers.

An important finding of the USDA Report was that most farmers who had converted from conventional, chemical-based agriculture to organic or nature farming systems often experienced more severe weed, insect and disease problems during a transition period which seemed to last from two to three years. After the transition, however, many farmers reported that these problems were manageable and controllable with non-chemical methods as the new system became stabilized. Yet, while many farmers in the USA would like to convert to organic/nature farming systems, they are aware that there are possible risks in doing so. Consequently, the question most frequently asked by U.S. farmers is “How can I convert from conventional agriculture to organic or nature farming successfully and profitably, and with minimum risk?” In the USA, we have attempted to answer this question through on-farm research, demonstration, and testing of alternative agricultural practices which avoid the use of chemical fertilizers and pesticides (Parr and Hornick, 1994).

The Nature Farming Research and Development Foundation

The Nature Farming Research and Development Foundation (NFRDF) was founded in 1987 as a non-profit organization and is headquartered at the Naturfarm in Lompoc, California. At the Naturfarm, NFRDF manages 75 tillable acres to produce vegetables which are approved and certified as organically-grown by the California Certified Organic Farmers Association (CCOF) in conjunction with the State of California’s Organic Foods Act of 1990. The Naturfarm was established in 1988 to demonstrate the feasibility of large-scale vegetable production using nature farming methods and a permanent-bed system.

NFRDF's Mission

The purpose of the Nature Farming Research and Development Foundation is:

“To promote and develop the art and science of organic/biological agriculture and Kyusei Nature Farming for a sustainable agriculture and environment through research, education and development programs. Kyusei Nature Farming encourages the conservation and utilization of natural resources for the production of abundant, healthy and nutritious food to enhance the quality of life and responsible stewardship worldwide.”

Other NFRDF activities include:

- Producing research papers and educational materials,
- Planning and conducting workshops, farm field days, and outreach programs for farmers, consumers and environmentalists, and
- Working with local, national and international organizations to assist in the development of sustainable food production systems.

Kyusei Nature Farming

The principles of Kyusei Nature Farming were advocated more than 60 years ago by Mokichi Okada, a Japanese naturalist and philosopher, and founder of Sekai Kyusei Kyo (i.e., The Church of World Messianity). The Japanese word “Kyusei” means “saving”, and it implies that Kyusei Nature Farming can help to save the world through nature farming practices. Early on, Okada introduced his concept of a “living soil” as the foundation of Kyusei Nature Farming and emphasized the importance of maintaining and enhancing the productivity, quality and health of soils. He strongly believed that this, in turn, would ensure the production of safe and nutritious food, a healthy people, protection of the environment, and preservation of the natural resource base for future generations. Today, many scientists have reached similar conclusions based on mounting evidence that soil quality is the real “key” to a sustainable agriculture (Parr et al., 1992).

According to the teachings of Mokichi Okada, Kyusei Nature Farming is based on the following five requirements which practitioners strive to achieve:

1. It must produce high quality food to enhance human health.
2. It must be economically and spiritually beneficial to both producers and consumers.
3. It must be sustainable and easily practiced.
4. It must conform to nature and protect the environment.
5. It must produce sufficient food for an expanding world population.

Kyusei Nature Farming Compared with Conventional Agriculture

The principles, management practices and strategies which characterize Kyusei Nature Farming compared with those generally associated with conventional farming systems are listed in Table 1. It is apparent that Kyusei Nature Farming enhances the attributes of soil quality, i.e., soil productivity, environmental quality, food safety and quality, and human and animal health. While conventional agriculture can adversely affect these attributes. Those farmers who have properly applied the principles and practices of the Kyusei Nature Farming methods have found it to be economically-viable, environmentally-sound, and conserving of energy and the natural resource base.

Table 1. Principles, Management Practices and Strategies Commonly Used in Kyusei Nature Farming Compared with Conventional Agriculture

Kyusei Nature Farming	Conventional Farming
Utilizes organic amendments and natural inorganic substances to maintain soil fertility and productivity	Utilizes mainly chemical fertilizers to maintain soil fertility and productivity; often leads to environmental pollution
Reduces tillage intensity which improves soil structure and water-holding capacity, and controls soil erosion	Intensifies tillage which degrades soil structure and water-holding capacity, and accelerates soil erosion
Utilizes natural biological systems and biocontrol methods (e.g., natural predator and parasitic insects) to control weeds, insects and plant diseases	Utilizes mainly herbicides to control weeds, insecticides to control harmful insects, and fungicides to control many plant diseases
Utilizes crop rotations and soil building crops to maintain and improve soil quality and productivity, and protect the environment	Utilizes mainly intensive mono-culture cropping which accelerates soil degradative processes.
Utilizes on-farm resources to conserve energy and reduce costs	Utilizes mainly purchased off-farm energy sources
Produces healthy, safe and nutritious food which protects human and animal health, and poses no risk in the diets of infants and children	Produces food that may contain sufficient levels of pesticide residues to pose a substantial risk in the diets of infants and children

Special Management Practices at the Naturfarm

Maintenance of Soil Fertility and Productivity

No artificial or synthetic chemical fertilizers or pesticides are used at the Naturfarm. To do so would negate our organic certification status authorized by the California Certified Organic Farmers Association. A high level of soil quality is maintained by regular additions of agricultural compost applied at 10 tons/acre/year. In addition, a green manure crop called “soil builder” is grown alternately between cropping period to provide nitrogen fixation and soil organic matter, and to control weeds. The “soil builder” mixture consist of 40 percent bell beans, 20 percent Austrian winter peas, 15 percent woolypod vetch, 15 percent purple vetch, and 10 percent oats. “Soil builder” can fix up to 290 lb. (132 kg) of nitrogen per acre. Moreover, it yields tremendous amounts of biomass which improve soil tilth and fertility, and provides and excellent habitat for beneficial insects. The judicious use of these organic amendments allows us to farm successfully without the use of chemical fertilizers.

Pest Break Strips for Integrated Pest Control

An important practice at the Naturfarm which allows us to farm without chemical pesticides is the utilization of pest break strips. This technology was developed during 1990-92 by Dietrick et al. (1995) and utilizes a seed mixture called “Naturfarm Blend No. 2” consisting of alfalfa and clovers (white Dutch, strawberry, berseem, and crimson). The pest break strips are planted, usually five to seven beds wide (80-inch bed width), at strategic locations on the farm and serve as “traps” for insect pests by attracting them away from the adjacent vegetable crops. Most insects prefer the

“succulence” and nutrients of alfalfa and clover to feed upon rather than the vegetable crops. The pest break strips offer an additional advantage by providing a favourable habitat for beneficial insects which serve as natural predators against the pests.

Permanent-Bed Cropping System

Permanent-beds, 80-inches wide, are used exclusively at the Naturfarm, and all tillage, planting and harvesting equipment has been calibrated to this specific unit of measurement. This allows us to control weeds effectively with fewer tillage operations, extends the benefits of organic recycling, and utilizes controlled wheel-tract traffic patterns to minimize soil compaction.

Beneficial and Effective Microorganisms

An added dimension of Kyusei Nature Farming at the Naturfarm is the use of Effective Microorganisms (EM). These are mixed cultures of beneficial microorganisms which are applied as soil and plant inoculants to increase the microbial diversity of soils and the growth, yield and quality of crops (Higa and Parr, 1994). EM technology was developed by Professor Teruo Higa, a scientist at The University of the Ryukyus, Okinawa, Japan. Research is being conducted at The Naturfarm to determine the effectiveness of EM on crop yields when it is applied in combination with organic amendments which serve as carbon and energy sources for the EM cultures.

A greenhouse pot study was recently conducted by Rao et al. (1995) at Washington State University (Pullman, Washington, USA) to determine the effect and interaction of EM with three nutrient sources, i.e., compost, Bokashi and ammonium sulfate, on the growth and yield of wheat using a Naturfarm soil. In the first series of pots, the soil was either uninoculated or inoculated with a basal application of EM two weeks prior to planting. A second series of pots received the same basal application of EM and were then top-dressed with EM at 10, 20 and 30 days after plant emergence. Results show that the single basal application of EM significantly increased seed germination, dry matter yield and N uptake from the nutrient sources. However, the basal application of EM followed by top-dressing tended to decrease dry matter yield and N uptake. There appeared to be no advantage of top-dressing with EM when a basal application of EM was applied prior to planting.

Other researchers have reported results that are quite the opposite of these, i.e., where the benefits of EM are greatest from repeated applications during the growing period. Such conflicting results indicate that if we are to obtain maximum beneficial effects of EM on crop growth and yield we will need to expand our knowledge of how EM interacts with site specific conditions, including the soil (especially the indigenous soil microflora), the crop cultivar, and agro-ecological factors. Finally, those who produce EM must be able to ensure quality control with respect to specific cultures, inoculum density, and activity, so as to achieve a consistent level of performance and benefits from EM (Parr et al., 1994).

Summary

The mission of the Naturfarm in Lompoc, California, USA is to conduct research and development projects that promote the art and science of organic/biological agriculture and Kyusei Nature Farming. The Naturfarm is an organic farm which is certified each year by the California Certified Organic Farmers Association (CCOF) and inspected by the State of California for compliance with the Organic Foods Act of 1990. It is managed by the Nature Farming Research and Development Foundation (NFRDF), and supported largely by Sekai Kyusei Kyo, i.e., The Church of World Messianity. An active research program is underway to develop new and improved management practices which will help farmers to convert from conventional, chemical-based agriculture to nature farming systems which avoid the use of chemical fertilizers and pesticides. These practices must be economically-viable, environmentally sound, and conserving of energy and the natural resource base. They must also reduce the farmer's risk to an acceptable level during the transition from conventional to nature farming systems.

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