

**Embellish Agribusiness of Farmers by Organic Farming by  
Using Earthworms Vermicompost & Beneficial Sea & Rock Minerals  
Together for High Productivity of Chemical-free Nutritive &  
Health Protective Foods for Society'**



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**Kripa Drishti Publications, Pune.**

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## **PREFACE**

In Modern Agriculture, Production & Use of Agrochemicals for High Food Productivity, Development & Use of Modern Instruments, Electricity & Petroleum Products for Land Mowing, Tilling, Irrigating Soils and Harvesting the Crops also had some Adverse Effects on the Environment & Society

### **a). Production & Use of Agrochemicals (Chemical Fertilizers & Pesticides)**

Although it was essential to use the Agrochemicals (Chemical Fertilizers for Growth of Crops & Chemical Pesticides to Protect them from Pests & Diseases) for high food productivity to feed the fast-growing population of the world & protect from 'hunger' & 'starvation' it came as a 'Mixed Blessing' for the world. It was also termed as 'Green Revolution' when it was started in the 1960's. It adversely affected the Environment & the Agricultural Ecosystems all over world. It badly degraded & destroyed the 'natural fertility' of the farm soils & 'chemically contaminated' many of the foods produced. About 57 fruits & vegetables grown by the Agrochemicals have been found to be contaminated with the 'Residual Chemical Pesticides'. As mentioned earlier, several farmers are 'poisoned' every year all over the world by the use of Pesticides. Use of Chemical Fertilizers in farms also consumes more water for Farm Irrigation using huge 'Groundwater Resources' of Earth which is now fast depleting all over the World.

### **b). Use of 'Metals' & 'Materials' for Production of Farm Vehicles and Instruments**

In modern times, production of metals like 'Iron & Steel', 'Copper & Aluminium' are required in large amounts for the production of Machines & Equipments for development of 'Food Farms' in the fertile Forested areas by removing the Trees, mowing & tilling the Soils to remove the 'weeds & grass'. These days 'Mowing Equipments & Vehicles' (Tractors) for Soil tilling in Farms are also needed all over the world as the farm soils have become very 'Hard & Compact' due to heavy use of Agrochemicals. Equipments are also needed for Farm Irrigation and Harvesting of food crops especially the Cereal crops.

Metals are also required for the construction & development of Human Habitats (Homes), Industries (Producing Consumer Goods, Automobiles and all Transport Systems for the movement of People on Land, in Air and on Waters.

Production of metallic equipments also incurs massive Environmental damages in the 'mining' for extraction & processing' of the 'Iron Ores' & other metals from the Earth crust due to 'deforestation', 'earth cutting' & 'soil erosion'. They also cause massive 'air & water pollution' and use of massive groundwater resources which is fast depleting from Earth all over the world. Similarly, massive Environmental damages occur in the production and use of Agrochemicals for Farm productions.

### **c). High Use of Petroleum Products in Vehicles & Instruments in Farms for Mowing, Tilling, Irrigation and Harvesting**

(N.B. Now the Global Promotion of 'Electric Vehicles' & use of 'Clean Hydrogen Fuel' in Automobiles will also be Used in the Vehicles & Instruments Used in Farms).

Currently, Petroleum products (Petrol & Diesel) are used in all the Automobiles, Aeroplanes, Ships & Boats for faster movement of people across the world through Land, Air & Water in Oceans & Rivers. It is essential for the rapid movement of human society in world for their works & day to day activities. Farmers also need them for the operation of Farm Vehicles (Tractors) and in Instruments for 'Land Mowing', 'Soil Tilling' & 'Harvesting of Crops'.

Billions are invested in the mining of Petroleum Products and in their drilling equipments. Oil Drilling & Refining of Petroleum products generates huge 'Toxic Wastes & Pollutants & Greenhouse Gases (GHGs) and contaminates vast land areas. Automobile operated on Petroleum products emit huge 'Toxic Pollutants' & GHGs inducing 'Global Warming & Climate Change' which is an 'Apocalyptic Peril' compared with the 'Weapons of Mass Destruction'. About 4.3 tons of GHGs are emitted every year by an average Car. Diesel vehicles emit over 100 'micro-particles' several of which are 'Carcinogenic'. According to United Nation Environment Program (UNEP) over 3 million People in world die every year from Air Pollution related diseases. Polluted air is responsible for increase in Cancer by a third, Infant Mortality by a two-third, Heart ailments by 40% and Miscarriages by half since 1970. Non-cigarette smoker Lung Cancer rate is about 2000 cases each year.

Fortunately, for the safe future of society 'Zero Pollution' 'Electric Vehicles' & 'Hydrogen Powered' Automobiles are being promoted now all over world. Man reached on the Moon in 1969 using the 'Clean Hydrogen Fuel' in the Space Flights.

Hydrogen has the highest density of Energy per unit of weight. It has much more Energy content (34 kcal/gram) than Coal (7.8 kcal/gm) & Petrol (10.3 – 8.4 kcal/gm) with emission products only as Water Vapor & Nitrogen Oxides. When cooled to a Liquid state it takes up only 1/700 as much space as it does in its gaseous state. Civilization will never run out of Hydrogen as it can be generated from all Waters & also from Organic Wastes. U.S., Australia, India, Japan & Canada are ahead in promoting the 'Zero-Pollution Vehicles'. They are also operating Hydrogen Powered Buses. The Netherlands, Italy, Germany and U.K. are also taking lead.

**d). High Use of ‘Electricity’ to Power & Enlighten the Farms & Operate the Instruments. (N.B. Now the ‘Solar’ & ‘Wind Power Plants’ are being installed in Farms all over the World).**

Huge electricity is required everyday to ‘Power & Enlighten’ the Agriculture Farms and to operate the ‘Irrigation Plants & Machines’ in Farms. So far Electricity generated from the ‘Coal Power Plants’ are used in Farms which badly pollutes our ‘Breathing Air’ all over world. Today about 189 ‘Hazardous Chemicals’ have been identified in the atmosphere. It also takes out more ‘Carbon’ from the Earth and put it into the atmosphere which then works as ‘Greenhouse Gas’. Billions are invested in the mining of Coals. Many nations in the world including India & Australia are now closing their ‘Coal Power Plants’.

Similarly, multi-billions are invested in the mining of ‘Uranium’ & development of ‘Nuclear Power Plants’. They emit more dangerous ‘Radioactive Elements’ in the environment. Many nations in the world including Australia & India have closed their Nuclear Power Plants after the ‘Nuclear Disasters’ in some nations.

**Promotion of ORGANIC FARMING will only Resolve all the Above Environmental Problems & Help the FARMERS & Society to Live Safely**

Organic Farming is a unique ‘Agribusiness’ for the Farmers (Feeders of the Nations) giving them opportunity to work with ‘Mother Nature’. The need for improved ‘Organic Farming’ skills has been identified as crucial for the Farmers to maintain the sustainability of their Agribusiness and also protect their health. Today the Farmers all over world have to deal with increasingly complex issues for their Farming & Food Production such as ‘Use of Toxic Agrochemicals’ to ‘Fertilize the Farm Soil’ & for the Control of ‘Pests & Diseases’, ‘Depleting Groundwater Resources’ and the ‘Changing Quality & Quantity of Water’ needed for ‘Farm Irrigation’, ‘Degrading Farm Soil & Deteriorating Their Natural Fertility’, ‘Impacts of Climate Change’, ‘Growth of Glyphosate-resistant Weeds in Farms’, ‘Uncertain Commodity Prices’ & ‘Increasing Prices of Farm Inputs’.

Now ‘Solar’ & ‘Wind Power Plants’ are being promoted all over world to generate Electricity with ‘no pollution’. Agriculture Farms have also become very suitable place for installation of ‘Solar Panels’ & ‘Wind Power Plants’ due to large open areas with brighter sunshine & higher wind intensity blowing for longer time. Many farmers in world are now installing ‘Solar Panels’ & ‘Wind Power Plants’ in their Farms to generate Electricity for use in their Farms without any problems in Agriculture Production. This has been termed as ‘Agrovoltatics’. They are supplying their excess electricity generated to the local Govt. with good returns. This is further embellishing their ‘Agribusiness’ & boosting their Economy.

Modern Solar Panels generate 260 kWh of Electricity, paying back the cost within few years & then becomes free for Electricity generation. It is also ‘maintenance free’. Australian Farmers reported 170 % return on investments they make on

installation of Solar Panels in their Farms. Photovoltaic 'Solar Farms' using 12.5 square km of land can supply Electricity to whole of Australia for one year. Organic Farmers in world will become producers of 'Chemical-free Foods' & generators of 'Pollution-free Energy'.

But, even in the promotion of 'Organic Farming' in World operation of some of the above developmental activities will be needed for Global Agriculture.

These are-

- 1). For the production of 'Metals' for development of Farming Vehicles & Equipments, generation of 'Electricity' to power the Farms & Equipments;
- 2). Use of Petroleum Products for the Farm Vehicles used for 'Land Mowing' & 'Milder Soil Tilling' as the Farm Soils becomes very soft by the use of Organic Fertilizers especially the Earthworms Vermicompost. Earthworms also regularly burrow the Soils by their movement making them soft & aerated. Also, less irrigation of water will be required as the 'Moisture Holding' capacity of the soils significantly increases by use of Vermicompost.

But once there is 100 % promotion of 'Solar & Wind Power' Plants, 'Electric' & 'Hydrogen Powered' Vehicles all over the World, Organic Farming will become a 'Blessing' for the Farmers & the Global Human Society. Production & use of Metallic Equipments will also become much safer.

Farmlands where we grow our foods are the basis of survival of mankind on Earth & the Farmers are our 'feeders' sent by God. Former Prime Minister of India Sir Lal Bahadur Shastri highly appreciated the Farmers of World as the 'Feeders of Nations' and gave the slogan 'Jai Jawan, Jai Kisan' highlighting the role of Farmers like the 'Army of Nations' to protect the Society.

About 99.7% of 'human foods' comes from the Farmlands, which is shrinking by more than 10 million hectares every year due to 'Soil Degradation & Erosion'. The growing 'Natural Disasters' due to 'Global Warming & Climate Change' are also destroying the Farmlands all over the world by 'heavy rainfalls' & 'leaching of soils'. In 1950 there were 2 million acres of Agricultural land in the World. Today, there is less than 600,0000 acres. Every year, nearly 27 million hectares of 'Fertile Soil' is lost. 30 % of the Worlds 'arable lands' has become 'unproductive'. Food & Agriculture Organization (FAO) has warned that World's Soil was degrading so fast that after 30 years it may not be able to feed its growing population. In U.S. it is costing the Nation & the Farmers the losses of about US \$ 37.6 billion each year in 'food productivity'. Worldwide the economic losses incurred by the Farmers (Feeders of the global human society) due to lower 'food productivity' is estimated to be about \$ 400 billion per year.

Dr. Norman Ernest Borlaug was a Nobel Laureate American agronomist who initiated the 'Green Revolution' worldwide in the 1960s in Mexico. Indian Agriculture Scientist Prof. M.S. Swaminathan collaborated with Sir Norman Borlaug & spearheaded a mass movement with farmers in India towards the goal of 'Green Revolution'. The high yielding varieties of Wheat and Rice developed by Dr. Swaminathan and Dr. Borlaug were the foundation of the Green Revolution. It saved many underdeveloped & developing countries from certain famine-like conditions in the 1960s. The term 'Green Revolution' to enhance the high productivity of Foods by use of Agrochemicals to feed the growing population on Earth was coined by the great U.S. Agriculture Scientist Prof. William Gaud in 1968. However, the Agrochemicals which ushered in the 'Green Revolution' in the late 1960's came as a 'mixed blessing' for mankind. Use of Agrochemicals over the years increased the 'Quantity' of foods but decreased its 'Nutritional Quality' essential for 'Good Health', 'High Strength & Vitality'. It also destroyed the 'Physical & Bio-chemical Properties' of the farm soil reducing the 'Essential Minerals' & 'Beneficial Microbes' important for increasing the 'Natural Fertility' of the Soil.

Excessive use of Chemical Fertilizers also results in loss of 'humic contents' in the Farm Soil which is essential for formation and development of 'roots' in plants and 'plant growth'. Food productivity is declining while the cost of Agrochemicals is rising, increasing the cost of 'Food Production' with 'Diminishing Returns' to the Farmers.

Adverse effects of overuse of Agrochemicals and its hazardous impacts on the human health and the environment is being felt now. According to United Nation Environment Program (UNEP) & World Health Organization (WHO) some 25 million Farmers and Agricultural workers are 'Poisoned' by 'Chemical Pesticides' & some 10–20,000 people in world die every year from it. Several Fruits & Vegetables grown by Agrochemicals have been found with some 'Residual Pesticides'. U.S. Scientists predict that up to 20,000 Americans may die of Cancer, each year, due to them. Global Chemical Agriculture also emits some 33.3 % of the 'Green House Gases' (Carbon Dioxide, Methane & Nitrous Oxide) into the atmosphere inducing 'Global Warming & Climate Change'. It is all due the the production & use of Agrochemicals & aggressive 'Plowing' (Soil Tilling) as the Farm Soils becomes hard due to heavy use of Agrochemicals. When water mixes with 'Nitrogenous Fertilizer' and there are is no Crops in the farm to absorb it, there is huge emission of 'Nitrous Oxide' which is over 300 times more powerful GHG than Carbon Dioxide with much greater Warming potential. There are approximately 720 billion tones of Carbon (C) in our atmosphere. 60 million tons of Carbon is added annually from Soil when the farmlands are plowed, releasing 'Organic Carbon' into the air. According to Australian Greenhouse Office (AGO), Australia has 473 million hectares of Agricultural land & emitted 537 million tons of CO<sub>2</sub>-e (equivalent) of GHG in 2009. Chemical Farming is proving highly destructive for the Environment & Society, especially the Farmers all over the world.



'Strength & Vitality' of people in the World is also reducing due to eating of Chemically grown foods with 'Poor Nutritional Quality' and many 'Health Problems' including 'Cancers' & 'Heart Diseases' are increasing even in the 'Rich Society' who can afford to eat the best foods from the market. According to World Health Organization (WHO) over 35,000,000 people in the World are suffering from 'Arthritis' & 'Muscle Pains'. According to the 'United States Soil Conservation Department' (USSCD), U.S. produces more foods than any other nations in the World with enough foods for the society to eat, yet 40 % people suffers from 'Malnutrition' as the foods do not have enough essential 'Minerals' & 'Vitamins' to keep them healthy. The cause of all these 'Human Health Problems' due to the 'Depleting Soil Minerals' & 'Chemicals in the Foods' has been scientifically confirmed now.

In January 1968, even before the term 'Green Revolution' was coined by Prof. William Gaud, the great Indian Agriculture Scientist, Prof. M. S. Swaminathan, proudly acknowledged as 'Father of Indian Agriculture' in his Presidential Address at the 'Indian Science Congress' drew attention towards the 'adverse consequences' of the excessive use & applications of 'Agrochemicals' in Farms and showed the world the pathway to 'Ever-green Revolution' for achieving higher productivity of 'Nutritive Foods' without damaging the farm soil & harming the farmers. This is a system of Agriculture that involves the use & sustainable management of 'natural resources' of Earth (beneficial minerals & microbes from the green plants & soil animals, excreta of farm animals & minerals from oceans & rocks) for enrichment of 'soil fertility', 'farm biodiversity' and enhancement of 'food productivity' with their 'nutritional quality'. The 'International Federation of Organic Agriculture Movement' (IFOAM) has defined 'Organic Agriculture' as all Agricultural Systems that promote the 'Environmentally', 'Economically' and 'Socially' safe & sustainable production of 'Foods & Fibers'.

Hence, the only solution is promotion of 'Organic Farming' for which the World Farmers have to go back on the systems of 'Traditional Agriculture'. But now more powerful 'Organic Fertilizers' can be produced by Vermicomposting of all human 'Organic Wastes' by the waste-eaters Earthworms whom the great visionary Scientist of World Sir Charles Darwin in the 18th Century called them as 'Unheralded Soldiers of Mankind & the Friends of Farmers Working Day & Night Under the Soil'. Organic Farming promoted by Fertilization of Soil by 'Earthworms & its Vermicompost (produced from the Organic Wastes - Food, Farm & Green Wastes) & Mineralization of Soil by 'Sea & Rock Minerals' will provide 'High Growth & Productivity of Food Crops', 'Resistant' against 'Pests & Diseases', producing 'Nutritive Foods' with 'High Quantity & Quality' rich in 'Proteins', 'Vitamins' & 'Minerals' for 'Good Health' with 'High Strength & Vitality' in people.

Earthworms derive their name from 'Earth' meaning 'Soil'. They occupy over 80% of the Invertebrates soil animals in the Terrestrial Ecosystem and are the largest members of Oligochaeta 'Segmented Worms'. They play essential roles as 'Waste

Managers' (managing both Solid Wastes & Wastewaters of Society by converting them into 'Useful Resources' for the Farmers), 'Soil Managers', 'Soil Fertility Improvers', and 'Growth Promoters of Food Crops' in our Global Ecosystem. The ancient Greek Philosopher Sir Aristotle (384 – 322 BC) globally acknowledged as 'Father of Biology', described Earthworms as the 'Intestines of the Earth' for their ability to feed on the soil and enrich them with 'humus' which is high in 'organic matters' and 'beneficial soil microbes'. Humic substances in the soil also help in the development of 'roots' in plants. The Ancient Indian Horticulture Scientist Sir Surpala way back in the 10th Century, wrote a book in Hindi 'Vrikshayurveda' ('Science of Tree Growing') where he mentioned to 'Use Earthworms to get Good Quality of Fruits of Pomogranate' educating the world about the 'Food Productivity' values of Earthworms.

In 2004, the great Russian Vermiculture Scientist Sir Anatoly Igonin wrote that – 'No one and Nothing can be compared with the Earthworms. They are the Creators of the Soil. They are 'Disinfecting', 'Neutralizing', 'Protective' and 'Productive' Organisms on Earth'. The great Vermiculture Scientist of India Prof. Radha Kale has called Earthworms as 'Nature's Quiet and Biggest Gift to Civilization for Safe & Healthy Living'. Earthworms also changes the biochemical properties of the farm soils contaminated with 'chemical pesticides' or 'heavy metals' due to massive use of Agrochemicals. They overcome the human-triggered heavy metals and pesticides pollutions. They also have the ability to eliminate the 'hydrocarbons' and several 'toxic chemicals' from the soils. (Srut et al. 2019; Sanchez-Hernandez, 2019).

Earthworms can bio-degrade all 'Organic Wastes' (Municipal & Industrial) into Vermicompost (Nutritive Organic Fertilizer) for the Farmers. This they do by multiple actions - grinding them by 'Muscular Action' followed by breaking them by 'Enzymatic Action' and then by decomposing them by the 'Decomposer Microbes' which are proliferated by the Earthworms in the Composting System. The enzymes present in the Earthworm gut play a major role in Vermicomposting of Organic Wastes (Ravindran et al. 2016). Guts of Earthworms are storehouse of 'Microbial Flora'. Given the optimum 'temperature and moisture' the Earthworms enhances 'Bio-degradation' and 'Decomposition' of Organic Wastes from 60 to 80 %. Each Earthworm eats the 'Waste Materials' at least 8 times & leaves the end-products free of all Chemicals.

Vermicomposting of Organic Wastes by Earthworms has been a technology of 'Sustainable Management' of 'Human Wastes' while also reducing the emission of 'GREENHOUSE GASES' (GHGs) and significantly improving the levels 'Soil Organic Carbons' (SOC) in the farm soils by use of Vermicompost as Organic Fertilizers in farms. It will also lead to significant increase of 'Soil Fertility & Crop Productivity'. The Intergovernmental Panel on Climate Change (2000) recognized that 'Carbon (C) Sequestration' in Soils by addition of 'Composts' as one of the possible measures through which the 'Greenhouse Gas' Carbon Dioxide in the atmosphere inducing 'GLOBAL WARMING & CLIMATE CHANGE' can be reduced. According to the reports of 'Climate Council of Australia' Climate Change

is also affecting the 'Mental Health' of Society all over world. They also recommended Vermicomposting of Wastes by Earthworms as one of the beneficial measures for managing 'Human Wastes' with significantly 'Low Emission' of GHGs. Hence, Earthworms & its Vermicompost can play a good role in the strategy of Greenhouse Gas reduction & Mitigation of 'Global Warming & Climate Change' which is inducing Natural Disasters & affecting the 'Brain & Mental Health' of Society all over world.

Earthworms can also Purify (Disinfect & Detoxify) the 'Wastewaters' (Municipal & Industrial) & make them 'Nutritive' (rich in NKP) to be used by the Farmers for Farm Irrigation helping them in fighting the 'Water Crisis' they are facing today due to the 'Global Warming & Climate Change' and the fast depleting 'Groundwater Resources' all over the world. Farm Irrigation by Vermifiltered 'Clean & Nutritive Water' by Earthworms will also give high 'Food Productivity' to the Farmers without the use of any Fertilizer & embellish their Agri-Business. In an Indian study on Rice crops the average seed count was 371 in single branch as compared to only 176 in Rice grown on normal water.

Earthworms are also tolerant to many 'Chemical Contaminants' including 'Heavy Metals' and 'Organic Pollutants' in the Soil. They can 'Bio-accumulate' & 'Bio-degrade' or 'Bio-transform' the Chemicals in the chemically contaminated Soils. They can remove the 'Heavy Metals', 'Pesticides' & 'Lipophilic Organic Micro-pollutants' from the Soil in the Wastelands & Vermiremediate the Soil into 'Clean' & even 'Fertile Soil' (rich in beneficial minerals & microbes) to be used for farming by the farmers. Being 'bisexual organisms' Earthworms reproduce very fast. They produce upto 3 Cocoons every week & from every Cocoon about 10-12 tiny Worms emerge. Huge 'Earthworms Biomass' are generated during all the Vermiculture processes (Vermicomposting, Vermifiltration & Vermiremediation Systems) which are very useful for the Farmers & Society both Socially, Economically & Environmentally.

Humans have also used the Earthworms as 'Foods' & 'Medicines' since time immemorial. They are organisms of 'High Nutritional' value containing complete 'Proteins', 'Peptides', essential 'Amino Acids', 'Carbohydrates', essential 'Long-Chain Fatty Acids' and wide range of 'Trace Elements', 'Enzymes,' 'Vitamins' & 'Antioxidants'. They are also considered as an ideal animal for obtaining 'High Protein' feed materials for Cattles, Poultry & Fishes. They are rich in Protein (64-72 % by dry weight) with 70-80 % high quality essential amino acids 'Lysine' & 'Methionine' which are 'low amino acids' in most 'Human Foods & Cattle Feeds'. Proteins are very important for 'Growth', 'Good Health' and 'Development' of Human Body. It also increases the 'Body Resistance' against diseases and reduces the incidences of many diseases.

Earthworms have 'Innate Defense Mechanisms' & 'Strong Immune System' protected from Bacteria, Fungi, Protozoa, Virus & Parasites etc. They have been used in the 'Traditional Medicine' for thousands of years in India (as Ayurvedic

Medicine) and in many parts of the World for the treatment of many human diseases such as 'Inflammation of Body Parts', 'Abdominal Pains', 'Rheumatism', 'Arthritis', 'Mumps' and 'Measles'. 'Folk Medicine' also used them in the treatment of 'Cancer', 'Ulcers', 'Diarrhea', 'Fever', 'Dysentery', 'Hypertension', 'Smallpox', 'Dental Problems', 'Headache', 'Fever', 'Asthma', 'Chronic Cough', 'Jaundice' & 'Wound Healing'. They are also finding new uses in 'Modern Medicine' in the treatment of 'Heart Diseases' and several types of 'Cancers' and in the production of 'Antibiotics' from the 'Anti-pathogenic' Ceolomic fluid. No wonder why the great Indian Scientist Prof. Sultan Ismail gave the Earthworms the status of a 'Doctor' protecting the 'Health' of people on Earth. Nutritional & Medicinal properties of Earthworms will make them excellent sources of 'Dietary Supplements' for human beings and will help the Farmers & also the Organizations promoting Vermiculture to produce 'Earthworms Biomass' & expand the market of 'Vermi-Meals' & 'Vermi-Medicines' in world embellishing their Agri-Business.

In 1929, Sir Robert McCarrison in British India had observed that the people in the 'Himalayan Mountain Valley' growing Foods by irrigating with water flowing from the Mountain Rocks always lived 'Healthy' with 'High Strength' and 'Longevity'. People of Hunza valley in the Himalayan region 'never get sick'. They 'live long' with 'high strength & vitality'. They irrigate their Farm Soil by Water from the Glacier containing 'Rock Minerals'. He suggested the Farmers all over world to use 'Rock Minerals' in Farm Soils to grow 'Nutritive' & 'Health Protective' Foods.

U.S. Medical Scientist Dr. Maynard Murray (1900-1982) found that in the Sea Animals diseases like 'Arthritis', 'Arteriosclerosis' and even 'Cancer' & 'Aging' never existed on a cellular level. They were all living healthy with the intake of 'Feed Materials' from the Sea. He educated the Farmers about 'Mineralising the Farm Soils' with 'Sea Minerals' to produce 'Health Protective Nutritive Foods' to give 'High Strength & Vitality' to people after he observed the Sea Animals living virtually 'Disease-Free'. Most Crops require an average of 40 mineral elements from the soil for healthy growth. Both Sea Water & Rocks have about 90-100 mineral elements. Chemical Fertilizers only give 6 mineral elements. Earthworms Vermicompost also contains 13 'essential minerals' with beneficial 'soil microbes' which help plants to absorb the 'Minerals' by their roots. The 'Nitrogen Fixing Bacteria' & 'Phosphate Solubilising Bacteria' in the soil help the plants to absorb & bio-accumulate Nitrogen (N) & Phosphorus (P) by changing them in their 'bio-available' forms necessary for absorption by roots. 'Soil Minerals' are also necessary for the function of 'Soil Microbes'. In studies in USA, Australia & India, Sea Minerals produced 29 Kg of Wheat compared to 20 Kg by Chemical Fertilizer. Proteins in the Grains increased to 9 %. Vermicompost increased growth & yield by over 35 % and lifted Proteins by 12 %. In the Corn, Phosphorous increased by 57 %, Potassium by 90 %, Calcium by 47 % & Magnesium by 60 %.

In 2010, Dr. Hugh McLaughlin in an 'International Conference' in Birmingham (U.K.) also recommended to add Charcoal (named as Biochar) in the Farm Soil to restore its 'Natural Fertility'. It is produced from all kinds of 'Biomass' - Wood,

Manure, Leaves, Straw, Cornstalks, Rice Hulls or any burnable Organic Wastes. Once added in the Soil, it can stay there for Centuries maintaining the Soil Fertility & giving good Crop Productivity. It is just one-time investment for Farmers. It also increases the 'Water Holding' & 'Mineral Retention' capacity of the Soils. It also promotes the activities of 'Earthworms' in Soil, help in the proliferation of 'Beneficial Soil Microbes' & increases 'Nitrogen Fixation'. Biochar in soils also works to store 'Carbon' in the soil reducing the emissions 'Carbon Dioxide' which works as 'Greenhouse Gas' inducing Global Warming & Climate Change.

Today, all over world people are taking 'Nutritional Supplements' especially Calcium (Ca), Magnesium (Mg), Zinc (Zn), Potassium (K), Selenium (Se), Iron (Fe), Vitamins C & D etc. to maintain Good Health with 'High Strength' & 'Vitality'. Only 'Organic Farming' by Fertilization of Soil by the 'Earthworms' & its 'Vermicompost' & Mineralization by 'Sea & Rock Minerals' can save & sustain the Civilization in good health on Earth. It will also reduce 'Soil Degradation', maintain high 'Minerals' & 'Microbes' in Soil & enrich the Foods with 'Health Protective Nutritive Elements'. Value of 'Organic Foods' is now growing all over World. It significantly enhanced the Agri-Business of Farmers in U.S. which surpassed \$13.8 billion in 2005.

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**(For the Publisher of the Book and the Teachers & Scientists in World who Published their Works done on 'Boosting the Food Productivity' by Using 'Sea & Rock Minerals' in the Farm Soils gave us Great Knowledge in our Academic & Scientific Life. They also gave their KIND PERMISSION to mention some of their 'Brilliant Research Works' on 'ORGANIC FARMING' in our Current Book to give knowledge to the Farmers & Society in World inspiring the Farmers to Switch Over to 'Organic Farming' by Using both 'Vermicompost, Sea & Rock Minerals' for 'High Productivity' of 'Safe Chemical-free, Nutritive & Health Protective' Organic Foods for the Safety of Global Human Society. They are People sent by GOD on Earth to help us & the Farmers & Society of World)**

First we feel highly grateful to the brilliant Editor Mrs. Rajani Adam of K.D. Publisher, Pune, India for Publishing our Book to convey the knowledge to the World especially the Farmers (Feeders of Nations) about 'Organic Farming' & help them in increasing the productivity of 'Nutritive & Health Protective' 'Chemical-free Organic Foods' by using 'Earthworms & its Vermicompost' and the 'Beneficial Soil Minerals' from the 'Sea Water & Rocks' which would also boost their 'Economy' & 'Agribusiness'. Book Publishers comes from great Intellectual Community in World sent by 'God' to educate the Global Human Society' by publishing informative Books & Papers.

We feel highly grateful & thankful to all those Brilliant Scientists & Workers of World who worked and informed the World about the 'Food Productive & Health Protective' values of 'Sea & Rock Minerals' when used in 'Farm Soils' for higher productivity of 'Highly Nutritive Mineral-rich Organic Foods'. Way back in 1947, Sir Albert Howard in U.S.A., had told the world that the 'Health of People on Earth' is dependent upon the 'Health of the Soil' where we grow our Foods. Honourable Scientists working on 'Sea & Rock Minerals' are Dr. Sir Maynard Murray (1900-1982), Sir Robert McCarrison (1929), Sir Robert Cain, Dr. Jon Yencken, Dr. Adeon Asfar & Dr. Mike Sileck. Dr. Robert Cain, Founder of 'SeaAgri Solutions' also gave us his kind permission way back in July 2021 by his Email (robert@seaagri.com) to write about his works on 'Sea Minerals' in our Book. We are conveying his great knowledge about the values of 'Sea Minerals' in Farm Production to the Students & Farmers in the World through this book. We have mentioned his Email of 'Permission Granted' (dated 1st July 2021) at the end of Chapter 5 written on 'Organic Farming by Sea & Rock Minerals'. Other Brilliant Scientists & Workers on 'Sea & Rock Minerals' are Honourable Dr. M. Henderson, Dr. R.B. Duff, Dr. Julius Hensel, Dr. Stephen Daniels, Dr. R. Taylor, Dr. J.I. Rodale, Dr. C.Z. Sgherri, Dr. A. Kadlecova, Dr. F. Pardossi, Dr. Navari, Dr. R. Izzo. Dr. Allan Banik and Dr. T. Renee.

We are especially thankful to Sir Robert Cain & Dr. Jon Yencken, who educated the World about the knowledge given by the great Medical Scientist of World in U.S.A., Honourable Dr. Maynard Murray for 'Re-mineralization' of the Farm Soils with 'Essential Minerals' from the 'Sea Water' (Sea Solids) to improve the 'Nutritional Quality' with 'Quantity' of the Foods produced on them & save the World from the increasing 'Health Problems' especially related to 'Bones, Muscles & Heart' and Cancers. Dr. Adeon Asfar & Dr. Mike Sileck also helped them in this great work to protect the Global Human Society & for their 'Safe Living' on Earth.

Sir Robert McCarrison was 'Director of Nutrition Research' in British India. He studied about the value of 'Rock Minerals' in Farm Soil for the production of 'Health Protective Nutritive Foods' in 1929 & informed the World about the magnificent 'Body Strength', 'Vitality', 'Longevity' & 'Intelligence' in people living in the 'Himalayan Mountain Valley' near India who were eating foods grown by the 'Melted Ice Water' from the Ice Glaciers in the Mountains containing all 'Essential Minerals' from the Rocks. It also protected them from many 'Human Diseases'.

Studies & informations on the benefits of 'Sea & Rock Minerals' for the protection of 'Farm Soils' & production of 'Health Protective Nutritive Foods' (especially from 'Cancers & Heart Diseases' which are rising problems in world & a growing threat to the Civilization) was a new concept with great 'Scientific Knowledge' unknown to the world. We got this knowledge from their 'Informative & Eye-Opening' publications. Inspired by their great scientific discovery & knowledge given to the World, we also made some studies on the 'growth impacts' of diluted 'Sea Water' & grinded 'Rock Powders' on 'Potted Crops' with significant results. We are now suggesting the Master students in Australia & India to work on it to know more about them and help the Farmers.

All Food & Soil Scientists working on 'Vermicompost' & 'Sea & Rock Minerals' to promote 'Organic Farming' were very brilliant people sent by God on Earth to educate & inspire the Academicians like us & help the Farmers (our Feeders) in the World to produce 'Chemical-free & Health Protective Nutritive Organic Foods' for the society while also boosting their 'Economy & Agribusiness'. They are like 'Academic God-father' for the 'Farmers & Society' in the World. We have acknowledged all of them in our Book & also enlisted them in the list of 'References' & as 'Additional Readings'. There must be many brilliant 'Soil Scientists & Workers' on 'Sea & Rock Minerals' in the World about whom we did not know & could not mention their name in our Book. We feel highly 'grateful' to them also & sincerely apologise if we have not enlisted them & mentioned their names in our Book. We request them to kindly read & response to us. We will proudly mention & honour them in all our books in future.

We greatly acknowledge all those eminent Scientists of World whose brilliant works on 'Earthworms & Vermicompost', 'Sea & Rock Minerals' to boost the productivity of 'Chemical-free & Health Protective Nutritive Foods' for the global human society while also boosting the Economy of Farmers (Feeders of World) & embellishing their Agribusiness. They have also greatly inspired in our Academic & Scientific Life. Most important among them were Sir Charles Darwin of U.K., who recognized the value of 'Earthworms' for Farmers in the 18th Century and called them as an 'Unheralded Soldiers of Mankind & Friends of Farmers Working Day & Night Under the Soil'. Others are Sir Surpala of India who recognized the value of 'Earthworms' in 'Fruit Production' way back in the 10th Century A.D, Sir Dr. Anatoly Igonin of Russia who in the 19th Century said that the 'Earthworms' perform the 'Disinfecting', 'Neutralizing', 'Protective' & 'Productive' functions in the Biosphere. The great Indian Scientist Prof. Sultan Ismail gave the Earthworms the status of a 'Doctor' protecting the 'Health' of people on Earth. We are trying to revive their 'Scientific Memories', fulfill their 'Scientific Dreams' & 'Scientifically Validate' their great 'Scientific Visions' about the Earthworms.

We have special appreciation for great Women Vermiculture Scientist of India, Prof. Radha D. Kale whose publications greatly inspired us in our Researches on 'Earthworms & Vermiculture'. We also thank Prof. Maria Angelica Soto, great Women Vermiculture Scientist of Chile, who pioneered the development of innovative 'VERMIFILTRATION Technology' with Prof. Jose Toha in 1990's for 'Wastewater Treatment' by Earthworms & which 'Disinfect & Detoxify' the dirty Wastewater into 'Clean & Nutritive Water' (rich in NKP) for their re-use in 'Farm Irrigation', also saving huge Groundwater of Earth which is 'fast depleting' all over the World. We thank Prof. M.S. Swaminathan, proudly known as 'Father of Indian Agriculture', for his 'Scientific & Moral' encouragements to work on Earthworms.

We also feel highly grateful to all those 'Brilliant Researchers' & 'Vermiculture Scientists' in world especially, Dr. Ian Titov, Dr. D.M. McInroy, Dr. Z. Sun, Dr.A. Loudymary, Dr. J. Bhorgin, Dr. K. Uma, Dr.R. Moss, Dr. H. Mihara, Dr. M. Sumi, Dr.T. Muzumoto, Dr. R. Ikeda, Dr. M. Maruyama who worked & published papers on the production of 'VERMI-MEALS', 'VERMI-MEDICINES' & 'VERMI-DETERGENTS' from the Earthworms Biomass generated as 'by-products' during the operation of 'Vermicomposting' & 'Vermifiltration' Systems of Human Wastes (Solids & Wastewaters). We have also mentioned their works in our Book to convey their great knowledge to the World especially to the 'Farmers' to inspire them also to produce 'Vermi-meals', 'Vermi-medicines' & 'Vermi-detergents' in their Farms using the huge 'Earthworms Biomass' which will always be generated as 'by-products' in their 'Vermicomposting & Vermifilter Plants'. This will further boost their 'Economy' & embellish their 'Agribusiness'.



We also thank all those 'Farmers & Vermicomposters' in India, Australia & U.S.A. (especially Mr. George Hahn) who got highly inspired and motivated by our works and are now practicing 'Vermiculture in Agriculture' completely giving up the use of 'Toxic Agrochemicals'. George is also educating & inspiring other Farmers in U.S.A. Feed backs of those Farmers on 'Growth & Development' of various 'Crops' & the other benefits of use of Vermicompost have been very helpful to us in promoting further researches in Vermiculture. We have also mentioned some of their 'Feed Backs' in this Book.

We also thank the Members of 'National Heirloom Exposition' in California, USA who regularly organize 'Farmers Conference' in every two years to promote 'Organic Farming' in World. They invite Farmers, Agriculture & Vermiculture Scientists from all over the world. Prof. Sinha also participated several times. They have inspired thousands of Farmers in U.S.A. & also other Nations of World to switch over to 'Organic Farming' giving up the use of 'Toxic Agrochemicals' which are proving to be 'Health Hazard' for the Farmers & Society.

We also feel highly indebted to all the Editors of Journals in U.S.A., U.K. & India who published our Papers on Vermiculture namely – 'American Journal of Experimental Agriculture', 'American-Eurasian Journal of Agricultural and Environmental Sciences', 'International Journal of Global Environmental Issues', 'Journal of Agricultural Biotechnology and Sustainable Development', 'Journal of Environmental Protection' & 'Journal of Agricultural Sciences' in U.S.A.; 'The Environmentalist', 'International Journal of Sustainable Human Development', & 'International Journal of Environmental Education and Information' in U.K; 'Indian Journal of Environmental Protection' & 'The International Journal of Agricultural Sciences' in India.

We also acknowledge all those Book Publishers in the World who published our Books & Edited Papers in Books, highlighting our names in the Academic & Scientific World. Important among them are 'NOVA Science Publishers' (USA), ELSEVIER Publications (USA), SPRINGER Publications (USA), DISCOVERY Publications (India), AAVISHKAR Publishers, (India), POINTER Publishers (India), SURABHEE Publishers (India), ENVIRONMENTALIST Publishers (India), INDUS Publishing (India), INA SHREE Publications (India), ARIHANT Publishers (India) & now KRIPA DRISHTI Publisher (India). NOVA in USA published our several Books & Edited Papers in their Books. The best part is that they made all FREE Publications & also provided some FREE Copies of Books to us. We feel highly grateful and indebted to Ms. Nadya M. Columbus, the President of NOVA Publishers and all other Workers at NOVA mainly Tricia Worthington, Lisa Gambino, Stella Rosa and Sarah Kreans who always helped in Publication.

We also acknowledge our all our Teachers & Educationists in the Universities in India and Australia who helped to work in Vermiculture and taught about the Scientific Value of Earthworms in restoring & improving 'Soil Fertility' & boosting 'Farm Productivity', also helping in the researches we did on 'Earthworms and Vermicomposting of Organic Wastes'. Important among them were Prof. N.K. Mishra at Patna University and Prof. G.S. Nathawat at University of Rajasthan in Jaipur, India.

Finally, we acknowledge our ancestors from whom we inherited the 'Genes of Knowledge'. They always helped & inspired us in our Academic Life. Sri Ram Prasad Singh (Maternal Grand-father of Dr. Sinha) always use to inspire him since his childhood that only 'Studies' will bring happiness in life and not 'Money & Properties'. Prof. B.M.K. Sinha (Father-in-Law of Dr. Sinha & Maternal Grand-father of Dr. Singh) was a great Educationist & Vice-Chancellor of two Universities in Bihar, always inspired to write 'Books & Papers' for high achievements in Academic Life. Mr. J.K. Sinha (My Father & Grand-Father of Shweta Singh) studied in USA, was very keen to see her becoming Lecturer in University. She fulfilled his dreams. We also inherited the 'Genes of Knowledge' from our Grand-father & Great Grand-father Justice Ram Bilas Sinha whom the British Govt. appointed as first 'District Judge' of India in Bihar.

## FOREWORDS

### **Prof. Radha Kale**

(Retd. Professor of Zoology & Eminent Vermiculture Scientist of India)

How essential is Organic Agriculture for the Well-being & Safe Future of Mankind in World?

The Planet Earth is supporting the life of all living organisms and is characterized by the presence of three (3) major elements & two (2) conditions on Earth like 'Soil', 'Water', 'Air', 'Heat' and 'Space'. They cannot be borrowed from any other planets for their sustenance. It is the responsibility of human society to restore the appropriate elements & conditions on the Earth for their own safety and that of all other living organisms.

The terrestrial life on Earth exclusively depend on 'Healthy Soil' (soft & porous, rich in humus, beneficial microbes, carbon & all essential minerals), 'Potable Water' and 'Clean Air'. The mile-stone of achieving maximum yield of food crops to feed the growing population in a blindfolded way by heavy use of Agrochemicals, adversely affected the Soil, Air & Water during the course of time. Now it has alarmed the world to find alternative methods to grow foods with protection of 'Soil Health', the 'Breathing Air' & the 'Drinking Water' for safety & betterment of 'human health' on Earth.

For the protection & restoration of 'Soil Health' of farms the major contributors are the underground 'Soil Micro-flora'. They play major role in solubilization and mobilization of beneficial nutrients to the above ground flora. Soil Carbon (C) is the main source for restoring the 'microbial density' and for their activity in soil. Use of 'Biochar' (special Charcoal) which is mentioned in this Book would significantly increase the Soil Carbon. Apart from providing necessary energy for the Soil Microbes, Organic Carbon also improves the physical properties of the productive soil, such as 'Bulk Density', 'Porosity' and 'Water Holding Capacity'.

Other 'Meso and Macrofauna' including Earthworms that flourish in such soils, also improve the physical and chemical properties of the soil along with 'Microflora and Fauna'. These beneficial 'Soil Organisms' gets disrupted due to excessive use of Agrochemicals and the Farm Soils become 'unproductive'. To overcome this alarming situation for the Farmers and to restore the global 'soil health', many scientists and organizations in World are working hard by promoting 'Organic Farming' by use of Vermicompost & management of 'Pests & Diseases' through the use of 'Vermiwash' (body fluid of Earthworms) & by Bio-pesticides produced from some Plants with 'anti-pesticidal' & 'anti-microbial' properties. I have also been working on the agronomic values of Earthworms all my life and Dr. Shweta Singh and Prof. Rajiv Sinha are also dedicated workers on Vermiculture Technologies. This approach will pave the way towards Safe & Sustainable Agriculture in World.

Dr. Shweta Singh & Prof. Rajiv Sinha in their book on 'Organic Farming' has brought out the views and efforts of the Scientists who are committed to restore the 'Soil Health' in different ways. They have focused on the use of 'Vermicompost' by composting all the 'Organic Wastes' by Earthworms, use of Biochar (Carbon Solids from Charcoal) & use of beneficial 'Soil Minerals' from the 'Sea and Rocks' to supplement & compensate the depleting minerals from the Soil of Agricultural farmlands. They have all been well discussed in the book. This in turn will also support the fulfillment of 'trace elements' in human foods & nutrition, thus resolving & overcoming the problems of 'Malnutrition' in World.

Being an Women Vermiculture Scientist, I feel very proud that Dr. Shweta Singh & Prof. Rajiv Sinha have given the due credit to all the Women Scientists of World who are actively involved these days in spreading the importance of 'Organic Farming & Sustainable Agriculture' all over the world embellishing the Agri-Business of farmers – the 'Feeders of Nations'.

The final part of the book is dedicated to the importance of Earthworms for the Farmers & Society for highly economical production of 'Nutritive Meals' (rich in Proteins) for the Cattles & 'Health Protective Bio-medicines' which can even protect from 'Heart Diseases & Cancers'. Their enzymes like 'Proteases' and 'Lipases' which have many functional roles in the field of medicine and in animal feed have been well described in the book.

This is a well designed and exhaustive book that has covered the importance of 'Organic Agriculture' for the betterment & safety of Farmers (the food growers & feeders) & Human Society (the food consumers). It will be highly 'informative & useful book' for giving 'Good Knowledge' to the Students, Teachers & Researchers in Zoology, Botany, Vermiculture, Agriculture, Soil Science & Food Science in the World.

**Prof. Radha D. Kale**  
Professor of Zoology (Retd) & Vermiculture Scientist;  
University of Agricultural Sciences, Bengaluru, India;  
Research Adviser, Mount Carmel College, Bengaluru, India.

## FOREWORDS

**Prof. Nandjee Kumar**

(Ex. Vice-Chancellor, Magadh University, Bihar, India)

An 'Eye-Opener' Book for the Farmers (Food Growers) & Society (Food Eaters)

I feel immensely honoured to write the FOREWORD of this luminous book entitled 'Embellish Agribusiness of Farmers by Organic Farming for High Productivity of Chemical-free Nutritive Foods for Good Health & Food Security' authored by eminent Agriculture & Vermiculture Scientists, Dr. Shweta Singh and Prof. Dr Rajiv K Sinha (Australia). Prof. Rajiv Sinha was my Class Friend in M.Sc. (Botany) at Patna University, Bihar in 1968-70.

The authors have been working on Earthworms Vermicompost and Organic Farming for several years in India and Australia. Their research works in Agriculture and Vermiculture have already been published in several International Journals and Books. They have taken a further task of publishing a highly informative book on 'Organic Farming' with a view to extend the updated knowledge to the Teachers, Students, Scientists, Farmers and Society throughout the World. It is an 'eye-opener' Book for the Farmers & Society.

In my 50 years of academic life, I have gone through many books and papers on 'Organic Farming' but this book reflects a multidimensional manifestation of 'Organic Farming' promoted by the use of Earthworms & their Vermicompost and Soil Minerals from the Oceans and Rocks of Mountains for a significant enhancement of 'Soil Fertility' to boost 'Crop Productivity', get 'Highly Nutritive' & 'Health Protective' Foods. The Sea Water contains almost 85-92 naturally balanced 'Minerals' and trace elements while the Mountain Rocks contain about 100 'Minerals' and trace elements which are essentially required for good 'Soil Fertility' & good growth of Plants. The diseases like Arthritis, Arteriosclerosis and even Cancer do not exist in 'Sea Animals' as they live & feed in the Sea rich in 'Beneficial Minerals'. These diseases also do not exist in the Human population living in the Himalayan region as they eat foods grown in the soil irrigated by water from the melted Ice Glaciers containing 'Rock Minerals'.

Food crops grown by Earthworm Vermicompost, Sea & Rock Minerals yield highly 'Nutritive Food' with essential Proteins, Vitamins and Minerals which provide 'security' to human health. They are also resistant to 'Pest & Diseases'. Eating Organic Foods also maintain good health of the vital organs of human body such as Brain, Liver, Kidney, Eyes, Nose, Throat, Bones and Spleen while providing high 'strength' to human body and 'longevity' of life.

In this book the authors have given some very valuable information & knowledge about the role of Earthworms, their Vermicomposts and the Sea & Rock Minerals about the benefits of Farmers & Society. Important among them are –

1. Conversion of Organic Wastes (about 70% human wastes) into Wealth (Nutritive Organic Fertilizers giving high Food Productivity) for the Farmers.
2. Increasing ‘Natural Fertility’ of Farm Soil to boost the productivity of Chemical-free & Health-Protective foods.
3. Increase in ‘Moisture Holding’ capacity of the Farm Soil, reducing the use of Water for Farm Irrigation, helping to sustain the fast depleting ‘Groundwater’ of Earth and fighting the growing ‘Water Crisis’ in World.
4. Elimination of ‘Toxic Agrochemicals’ used in Farms for Food Production, which is working as ‘Slow Poison’ for the Farmers (The Food Growers) & the Society (The Food Eaters) & thus Protecting their health.
5. Reduction of emission of ‘Greenhouse Gases’ inducing ‘Global Warming and Climate Change’.
6. Significant boosting of Strength, Vitality and Longevity of human beings by eating Organic Foods rich in Nutritive Minerals.

Large areas of Farmlands in the World are being Chemically Polluted due to heavy use of ‘Toxic Agrochemicals’ with gradual loss of ‘Soil Fertility’, but the Earthworms and their Vermicomposts not only clean up the Farm Soil from the Pollutants but also improve their Physical, Chemical and Biological properties to enhance the ‘Natural Fertility’ of the Farm Soil.

The book also give some ‘eye opening messages’ on the use of Earthworm Biomass for promoting allied industries on the production of ‘Biological Medicines’ to protect even against the ‘Cancers & Heart Diseases’ & to produce ‘Nutritive Protein Meals’ to promote ‘Fishery, Dairy, Poultry & Piggery’ Industries that will further benefit the Farmers as well as the Society.

I am sure this book will be very useful for the Students & Teachers of ‘Zoology, Biotechnology, Agriculture & Soil Science’ and particularly for the researchers working on ‘Vermiculture Technology’ for ‘Sustainable Management’ of both ‘Solid Wastes & Wastewater’, ‘Restoring & Increasing the Soil Fertility’, ‘High Productivity of Chemical-free & Health Protective Organic Foods’, and ‘Decontamination & Remediation of Chemically Polluted Wastelands’ into Fertile Farm Lands’.

The brilliant authors have not only scientifically proven & highlighted the great vision of Sir Charles Darwin who called Earthworms as ‘Unheralded Soldiers of

Mankind and Friends of Farmers', they have also revealed some hidden treasure of 'Scientific Value & Actions' of the Earthworms in 'Waste Management', 'Disinfection, Detoxification & Decontamination' of 'Polluted Soils & Water', eradication of 'Pests & Disease Organisms' from Farms and production of 'Vermi-Meals', 'Vermi-Medicines' & 'Vermi-Detergents' which Sir Charles Darwin perhaps might have not have thought of.

**Prof. Nandjee Kumar**

Ex-Vice-Chancellor, Magadh University,  
Bodhgaya, Bihar, India.

## **Some KEY WORDS in the Book & their Importance**

**(For the Knowledge of Students & Teachers of World Studying & Teaching 'Food & Agriculture Science', 'Earthworms & Vermiculture Technologies' & 'Soil Science' for 'Beneficial Minerals & Microbes' in Soils to Restore & Improve Soil Fertility for High Food Productivity)**

**AGRI-BUSINESS:** (Boosting the Economy of Farmers – the 'Feeders of Nations').

**AGRO CHEMICALS:** (Chemical Fertilizers & Pesticides used in Agriculture for Food Production).

**AGRO VOLTAICS:** (Installation of Solar & Wind Power Plants in Agriculture Farms due to more Open areas with greater Sunshine & higher Wind Velocity)

**ANTIOXIDANTS:** (Health Protective substances rich in Organic Foods).

**AMINO ACIDS:** (Rich in Organic Foods, making Proteins & fighting Oxidative Stress).

**BIOLOGICAL DROUGHT:** (Farm Soils becoming 'Unproductive' due to decreasing population of beneficial 'Soil Organisms'- Earthworms & Microbes).

**BIOPESTICIDES:** (Non-toxic compounds protecting Crops from 'Pests & Diseases')

**BIOCHAR:** (Carbon-rich Charcoal restoring the 'Natural Fertility' of Soil while staying in Soil for Centuries).

**CARETENOIDS:** (Health protective Antioxidants- rich in Organic Foods).

**EARTHWORMS:** (The 'Creators & Protectors' of Soil on Earth & restorer of its 'Natural Fertility').

**ECO-AGRICULTURE:** Eco-agriculture is defined as an approach that brings together Agricultural production and conservation of biodiversity in the same landscapes.

**EM-AGRICULTURE:** Agricultural production by the application of 'Effective Microorganisms' (EM).

**FOODS PREVENTING & PROTECTING from DIABETES:** (Organic Foods rich in 'Antioxidants' control Blood Sugar & Protect from Diabetes).

**FOODS PROTECTING HEART:** (Organic Foods rich in 'Antioxidants' also protect Human Heart & prevent the Cardiovascular Problems).



**FREE-RADICALS:** (Produced in human body by breathing 'Polluted Air'. Damage the 'Living Cells' in body inducing Cancers).

**FOODS PREVENTING CANCERS:** (Organic Foods rich in 'Antioxidants' also reduce the risk of all types of Cancers).

**FOLIC ACIDS:** (Organic Foods rich in Folic Acids also play important role in 'Cell Division', development of 'Nervous System' & protection of 'Heart').

**GROWTH HORMONES:** (Earthworms also produce biochemicals like Growth Hormones - Auxins, Gibberlins & Cytokinins essential for 'Plant Growth').

**GLUTATHIONE:** (Organic Foods are also rich in Antioxidant 'Glutathione'. It protects the human 'body cells' against various 'Reactive Oxygen' - 'Oxy-radicals').

**HUMUS:** (Organic contents in Soil essential for 'Growth & Development' of 'Roots' & 'Survival' of Plants). Vermicompost is rich in humus. Their use enhances the 'humic contents' in the Farm Soil.

**MALNUTRITION:** (Poor Health conditions due to eating foods deficient in 'Essential Minerals' & 'Vitamins').

**MACRONUTRIENTS:** (Essential 'Nutrients' human body needs in larger amounts e.g. Proteins & Carbohydrates).

**MICRONUTRIENTS:** (Essential 'Nutrients' human body needs in smaller amounts e.g. Vitamins & Minerals).

**METHEMOGLOBINEMIA:** (Health hazard for Farmers due to 'Nitrates' in water released from the use of Agrochemicals).

**NEAR-INFRARED (NIR) & INFRARED (IR) LIGHT OF SUN:** 50 % of the Sunlight that reaches the Earth is made of 'Near-Infrared (NIR) & Infrared' (IR) Lights.

**NEAR-INFRARED (NIR) SPECTROSCOPY TECHNOLOGY:** It is one of the 'Tailor-Made Tool' for the Agricultural Researchers & Scientists & also for the Farmers in world to promote Sustainable Agriculture' by 'Organic Farming' more precisely.

**ORGANIC FOODS:** (Chemical-free foods, 'Nutritive & Health Protective' due to rich in 'proteins', 'essential minerals', 'nutrients' & 'antioxidants' produced by Organic Fertilizers).

**PROTEINS:** (Higher in Organic Foods essential for 'Vitality & Immunity' in human beings)

**PRECISION FARMING:** A concept of 'Rapid Farm Management'. It precisely gives rapid information about the 'Farm Soil' & about the 'Growth & Productivity' of the Food Crops at every stage of their growth & development.

**SOIL DEGRADATION:** (Declining 'Minerals & Microbes' in farm soil due to heavy use of Agrochemicals. They are essential for plant growth).

**SOIL REMINERALIZATION:** (Addition of 'Essential Minerals' in Farm Soil by use of Earthworms Vermicompost, Sea Minerals & Rock Dusts).

**SOIL MINERALS FROM ROCKS:** (People living in the Himalyan Mountain & eating foods grown by Water from the melted Ice Glaciers containing 'Rock Minerals' maintain very good health with 'Intelligence', 'Strength' & 'Longevity').

**SOIL MINERALS FROM SEA:** (In Sea Animals 'Arthritis', 'Arteriosclerosis', even 'Cancer' & 'Aging' do not exist. Humans will also get those health benefits by eating foods grown by Sea Minerals).

**SOIL MICROORGANISMS:** (Earthworms release huge 'Beneficial Microbes' in Soil. They help plants to bio-accumulate 'Minerals' & also protect them from 'Pests & Diseases').

**VITAMINS:** (Organic Foods are highly rich in Essential 'Vitamins' which boost 'Immunity' for Good Health).

**VERMI-COMPOSTING TECHNOLOGY:** (Waste-eater Earthworms bio-degrade the 'Organic Wastes' into 'Vermicompost' (Nutritive Organic Fertilizer).

**VERMI-FILTRATION TECHNOLOGY:** (Earthworms also purify (Disinfect & Detoxify) the 'Wastewaters' into 'Clean Nutritive Water' useful for Garden & Farm Irrigation)

**VERMI-REMEDICATION TECHNOLOGY:** (Earthworms also 'decontaminate' the Chemically Polluted 'Wastelands' & remediate them into 'Fertile Lands').

**VERMI-MEALS:** (Protein rich 'Feeds' for Cattles can be produced from Earthworms)

**VERMI-MEDICINES:** (The 'Anti-microbial', 'Anti-cancerous' & 'Clot Dissolving' compounds in Earthworms can be used in production of non-chemical 'Bio-Medicines' for treatment of Cancers & Heart Diseases).

**VERMI-DETERGENTS:** (The 'Anti-microbial' compounds from the Ceolomic Fluid & Enzymes from the tissues of Earthworms can be used in production of Biodegradable Detergents)

**VERMIWASH:** (Body fluid of Earthworms – working as powerful & Non-hazardous 'Bio-Pesticides')

**VERMICOMPOST TEA:** (Vermicompost Solution Brewed in Water. It is more 'Powerful Growth Promoter' & 'Plant Protector' from Pests & Diseases)

**ZERO SOIL TILLAGE TECHNOLOGY:** (Developed in India. Protect the Farm Soil from 'degradation' due to 'Massive Mechanical Tilling' used in modern Agriculture. Also save huge cost & time of Farmers spent in Farming).

# INDEX

**Chapter 1: Green Revolution for High Productivity of Foods by Agrochemicals - A ‘Mixed Blessings’ for Mankind: Disastrous Impacts of Agrochemicals on The Farm Soils & The Farmers - The Feeders of Nations, And on The Environment & Society ..... 1**

**Chapter 2: Massive Degradation of the ‘Farm Soil’ All Over the World Depleting The ‘Beneficial Soil Minerals’ Essential for Production of ‘Nutritive & Health Protective Foods’ and Preventing ‘Malnutrition’ & All Other Diseases Resulting from the ‘Deficiencies of Minerals’ in Farm Soils & The Foods Grown in Them..... 5**

2.1). Human Diseases Resulting from Mineral Deficiencies in Foods Due to..... 7

**Chapter 3: Towards Organic Farming to Protect the Farm Soils, restore its Beneficial Minerals & Microbes Improving its Natural Fertility to Produce Chemical-free & Health Protective Nutritive Foods for Safe Living on Earth .....10**

3.1). From ‘Green Revolution’ by Chemical Fertilizers to ‘Ever-Green Revolution’ by Organic Fertilizers:.....11

3.2). Four Principles Govern the Identification of Organic Farming:.....13

3.3). The Six (6) Objectives & Benefits of Promoting ‘Organic Farming’ for .....13

3.4). Health Impacts of Eating ‘Minerals Rich Nutritive Organic Foods Grown...15

3.5). Health Protective Value of Some Fruits & Vegetables Grown Organically ..17

3.6). Studies On Health Protective Values of Some FOODS (Cereals, Fruits, Vegetables, Spices, Nuts & Sweeteners): Their Productivity & Health Protective Values Increases When Grown Organically, Boosting the Agri-Business of Farmers: .....27

3.7). Government of Nations Inspiring Farmers (The Feeders of Society) to .....33

**Chapter 4: Restoring & Improving the Physical, Chemical & Biological Properties of Farm Soil by Increasing The ‘Beneficial Soil Minerals & Microbes’ for High Productivity of ‘Nutritive Organic Foods’ for Good Health of The Farmers (Producers of Foods) & Society (Consumers of Foods).....36**

4.1). Increasing The ‘Beneficial Minerals’ in Soil by Remineralization by Sea & Rock Minerals:.....41

a). Soil Mineralization by Sea Minerals: .....43

b). Soil Mineralization by Rock Dust & Powder: .....43

4.2). Increasing the ‘Beneficial MICROBES’ in Soil by Earthworms: The Creators of Soil & Microbes Helping Crops to Use the Minerals & also to Protect from Pests & Diseases: ..... 44

4.3). Production & Use of BIOCHAR (Special CHARCOAL) in Farm Soils to Restore & Improve its Structure, Tilth, Natural Fertility, Water Holding & Minerals Retention Capacity: ..... 46

4.4). Zero Tillage or No Soil Tillage Technology for Rice & Wheat Farming in India to Protect the Farm Soil from Degradation:..... 47

**Chapter 5: Organic Farming by Sea & Rock Minerals: Great Source of all Essential Minerals for Growth & Development of Nutritive & Health Protective Food Crops..... 49**

5.1). Some Reports on The Use of Sea Mineral Solids on High Growth &..... 54

5.2). Growth Impacts of Some ‘Beneficial Minerals’ in Soil on the Crop Plants: 54

5.3). Some Studies & Observations of Agronomic Impacts of Sea-90 Minerals & Rock Minerals on Food Crops: ..... 58

**Chapter 6: Organic Farming by Earthworms – The Great Gift of Nature to the Farmers for Creation & Protection of Fertile Soil on Earth for ‘High Productivity of Nutritive & Health Protective Organic Foods’ Boosting their Agribusiness & also Eradicating the ‘Toxic Agrochemicals’ from Earth: Some Studies on the Use of Earthworms & its Vermicompost..... 63**

6.1). Earthworms: The Great Farm & Soil Managers on Earth Created by Nature: ..... 65

6.2). ‘Vermicomposting of ‘Organic Wastes’ of Society by the Earthworms to... 66

6.3). Commercial Vermicomposting: A Good Agri-Business Opportunity for Farmers, Creating Self-Employment & also Combating Poverty for Poor Farmers ..... 78

6.4). Use of Vermicompost, Vermicompost Solution & Vermiwash to Improve . 82

6.5). Some Studies on the Use of Earthworms Vermicompost on the ‘Growth’, ‘Food Productivity & Nutritional Quality’ of Cereals, Fruits & Vegetables..... 91

6.6) Amount & Application Time of Vermicompost in Crops..... 95

6.8). The Economic, Environmental & Health Benefits to Farmers & Society..... 98

6.9). Nations Promoting Vermiculture Technologies in World to Boost the Agri-Business of Farmers by High Productivity of Foods with Huge Earthworms Biomass to Promote Allied Vermi-Industries: ..... 102

6.10). Earthworms – the Creators of Earth, Women - the Progenitor of Earth: .. 113

**Chapter 7: Biology of Earthworms: Discovery of Some New Scientific Roles of Earthworms for Helping the Farmers & Boosting their Agri-business by ‘Purifying the Wastewaters’ into ‘Clean Nutritive Water for Farm Irrigation’ & ‘Combating the Global Water Crisis’, Converting the ‘Wastelands into Fertile Farmlands’ and Production of Health Protective ‘Meals & Medicines’ & ‘Safe Bio-Detergents’ from Their Biomass..... 116**

7.1). Verm filtration & Verm remediation Technologies to ‘Detoxify & Disinfect’ the ‘Wastewaters’ to Produce ‘Clean Nutritive Water’ for Farm Irrigation & ‘Decontaminate’ the ‘Wastelands’ to Develop ‘Fertile Farmlands’ by Earthworms: .....	116
a). Promotion of VERMIFILTRATION Technology by Earthworms for Purification (Disinfection & Detoxification) of ‘Wastewaters’ for ‘Re-use’ of the Clean Nutritive Water in Farm Irrigation & Improving Crop Productivity: .....	117
b). Promotion of Verm remediation Technology by Earthworms For ‘Detoxification’ of ‘Contaminated Wastelands’ and Restoration of Its Physical, Chemical and Biological Properties to Convert Them Into ‘Fertile Lands’. .....	122
7.2). Use of Earthworms Biomass to Produce Health Protective ‘Nutritive Meals & Medicines’ and ‘Biodegradable Detergents’ to Increase the Agri-Business of Farmers .....	123
a). Production of Nutritive Protein Rich ‘Vermi-Meals’ From Earthworms .....	124
b). Production of ‘Vermi-Medicines’ for Treatment of Various Human .....	131
c). Production of Biodegradable Vermi-Detergents from Earthworms: .....	136

**Chapter 8: Use of Drones in Modern Agriculture to Promote Organic Farming & Help the Farmers Boost Their Agribusiness .....138**

8.1). Analysis of Farm Soil:.....	138
8.2). Planting of Crops: .....	138
8.3). Monitoring & Management of Crops from Damages, Diseases & Infections by Spraying of Bio-Pesticides: .....	139
8.4). Spraying of Crops by Water for Farm Irrigation: .....	139
8.5). Calculation of Vegetation Index: .....	139
8.6). Assessment of Health of Crops:.....	139
8.7). Weed Control:.....	139

**Conclusions & Remarks.....140**

**Final Words.....146**

**References & Additional Readings References Cited .....153**



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