# Organic Farming in India: Present Status, Challenges and Technological Break Through

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**Abstract**

Though the organic movement was initiated over a decade ago it has failed to gain the expected momentum due to several ambiguities. Organic farming is mostly envisaged as the stoppage of synthetic inputs and their replacement by organic alternatives i.e.use of organic manures and natural methods of plant protection instead of using synthetic fertilizers/pesticides. Organic agriculture relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. The major objectivity of organic farming resides on development of a self-sustainable farming system in harmony with nature which delivers ecologically and economically sustainable pure food with enrichment of surrounding biodiversity and its entire components. India holds a unique position among 172 countries practicing organic agriculture: it has 6, 50,000 organic producers, 699 processors, 669 exporters and 7,20,000 hectares under cultivation. India is poised for faster growth with the growing domestic market. Success of organic movement in India depends upon the growth of its own domestic markets. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in the world's organic market.

***Keywords:*** Ecofriendly, economic, organic farming, yield

## 1. Introduction

In the present agricultural scenario, crop yield is declining day by day despite maximization of chemical inputs. Vicious cycle of chemical farming is now exposed in the increasing crop un-sustainability, higher input requirement, poor soil quality as well as recurrent pest and disease infestation. Moreover, in the pretext of climate change yield interference has become quite predictable under the unpredictable weather conditions vis-a-vis hike in biotic potential. The excess/indiscriminate use of pesticides and fertilizers has led to the entry of harmful compounds into food chain, death of natural enemies and deterioration of surrounding ecology (Chitale et al., 2012). Enhanced use of pesticide has resulted in serious health implications to man and his environment.

Hence, enhancement and maintenance of system productivity and resource quality is essential for sustainable agriculture. Organic farming can solve many of these problems as this system helps to maintain soil productivity and effectively control pest by enhancing natural processes and cycles in harmony with environment. Today, it is clear to the agricultural community that organic farming is the best option for not only protecting/sustaining soil-plant –ecological relationship but to mitigate the adverse effect of climate change. However dearth of proper technological advancement is the major hindrance towards achieving the true objectives of organic farming. In this background, an Indian organic farming practice called Inhana Rational Farming (IRF) Technology has demonstrated some promising results that have brought forth the relevance of organic farming in today's agricultural scenario.

## 2. Definition and Objectives of Organic Farming

Though the organic movement was initiated over a decade ago it has failed to gain the expected momentum due to several ambiguities. Organic farming is mostly envisaged as the stoppage of synthetic inputs and their replacement by organic alternatives i.e.use of organic manures and natural methods of plant protection instead of using synthetic fertilizers/pesticides. But this is not true (Bhattacharyya and Chakraborty, 2005). However, organic farming is a far deeper concept that mere non-chemicalization. In real sense it refers to a comprehensive approach towards improvement of both health of underlying productivity of the soil and plant leading to the enrichment of the surrounding ecology; which is a pre-requisite criterion for sustainable agriculture. According to IFOAM, "Organic agriculture is a production system that sustains the health of soils, ecosystems and people". It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. The major objectivity of organic farming resides on development of a self-sustainable farming system in harmony with nature which delivers ecologically and economically sustainable pure food with enrichment of surrounding biodiversity and its entire components.

### 3. Organic Farming in India: Present Status and future

India holds a unique position among 172 countries practicing organic agriculture: it has 6, 50,000 organic producers, 699 processors, 669 exporters and 7,20,000 hectares under cultivation. But, with merely 0.7% of total agricultural land under organic cultivation, the industry has a long journey ahead (Bordolo, 2016). India produced around 1.35 million MT **(**2015-16) of certified organic products which includes all varieties of food products namely Sugarcane, Oil Seeds, Cereals & Millets, Cotton, Pulses, Medicinal Plants, Tea, Fruits, Spices, Vegetables, Coffee etc. The production is not limited to the edible sector but also produces organic cotton fiber, functional food products etc (Table 1).

Table 1: Export of Organic Agricultural Commodity from India (2014-15 to 2016-17)

| Organic Agricultural Commodity (Source : APEDA) | | Basmati Rice | Non-Basmati Rice | Other cereals | Fruits & Vegetables | Pulses | Processed Items | Fruits / Vegetable Seeds |
|---|---|---|---|---|---|---|---|---|
| 2014-15 | Qty (MT) | 3702284 | 8225564 | 6425297 | 3212091 | 222104 | 721622 | 12498 |
| | Rs. (Cr.) | 27598.71 | 20336.00 | 10233.02 | 12434.95 | 1218.10 | 12195.93 | 124.98 |
| 2015-16 | Qty (MT) | 4044833 | 6374172 | 1522707 | 2982038 | 255602 | 728224 | 10684 |
| | Rs. (Cr.) | 22714.37 | 15085.38 | 2561.24 | 12719.60 | 1655.44 | 12738.80 | 106.84 |
| 2016-17 | Qty (MT) | 3999722 | 6813397 | 1000640 | 5155810 | 137177 | 1320527 | 11680 |
| | Rs. (Cr.) | 21605.13 | 17121.08 | 1868.49 | 16138.49 | 1281.63 | 13121.44 | 116.80 |

Source: APEDA

### 4. World scenario of organic farming

According to the latest FiBL survey on certified organic agriculture worldwide, there were 50.9 million hectares of organic agricultural land in 2015, with the most organic agricultural land in Australia (22.7 m hectares) followed by Argentina (3.1 m hectares) and the United States (2 m hectares). There has been an increase in organic agricultural land in all regions with the exception of Latin America. A major relative increase of organic agricultural land was noted in many African countries, such as Kenya, Madagascar, Zimbabwe, and Côte d'Ivoire (Willer and Lernoud , 2017).

### 5. Organic Farming: Debating Issues among Agricultural Fraternity

*5.1. Can organic farming feed the World?*

The role of organic agriculture in food security is a debatable subject considering the loss of crop productivity and increasing cost of production. Theoretically organic farming is the best way to achieve ecologically and economically sustainable crop production and several scientific study also support the facts with encouraging results in comparison to conventional farming. However, technological breakthrough to practically exhibit large scale economically sustainable organic production without time loss is still at large.

*5.2. Does organic means free of pesticide residues?*

Studies conducted by various certification agencies indicate either no or very low levels (below detectable limits) of pesticides and other contaminants in organic food product. Residue found in organic product primarily results due to drift from conventional farms. According to an USDA survey, about 21% of the organic samples had detectable residues (Savage, 2016). However, organic food products are definitely more safer in terms of toxic residue, though there are few incidents of malpractice and violation, which need to be checked.

*5.3. Do organic products taste better?*

According to Yadav (2010),flavouring ingredients, oils and other taste giving components have been found to be higher in organic products. As per report, high yields achieved today in some fruit and vegetable crops with higher chemical fertilizers and other inputs under conventional farming have likely come at the expense of crop nutritional and organoleptic quality (Theuer, 2006).

*5.4. Does organic products increase the risk of food poisoning?*

*There is scientific debate on* these issues. Organic cultivation relies on higher use of manures. Hence, it is assumed that they pose higher risk of contamination (Yadav, 2010). However, majority of the studies conclude that there is no risk of any food poisoning or bacterial infection through organic products. They are as safe as any other products produced by any other system.

*5.5. Does organic products have more nutrition?*

There is a scientific debate regarding the nutrition quality of organic food in comparison to conventionally grown food. Exhaustive review made by Heaton (2001) indicated that in 43% cases, organic food was having higher nutrients, in 45% cases equal and in 11% cases lower nutrients compared to conventionally grown foods. In India, Bera et al. (2013) and Seal *et al* (2017) found comparatively higher polyphenol and vitamin C content in the organically grown tea and potato respectively. Although, there may be dispute, but trends indicate their superiority over conventional products.

*5.6. Is it possible to meet the nutrient requirements of crops entirely from organic sources?*

The basic requirement in organic farming is to increase input use efficiency at each step of the farm operations. This is achieved partly through reducing losses and adoption of new technologies for enrichment of nutrient content in manure as well as enhancing nutrient uptake and utilization efficiency of plant with scientific plant management practice. According to a conservative estimate, if we can convert major part of the bio-waste generated in India to organic manure; the manure produced would be about 440 million tonnes per year (Ramaswami, 1999). Tapping these resources and converting it to organic manure with technological advances, and step wise planning for resource regeneration will help to step forward towards self-dependency in organicnutrient management.

*5.7. Is it possible to manage pests and diseases in organic farming?*

Following the conventional cidal approach of pest management utilizing weaker organic pesticides cannot resolve the pest/disease issuesin organic agriculture. It can be effectively tackled only through improvement of plant health. A healthy plant is less vulnerable to pest and disease infestation. Therefore, a major aim for the organic farmer is to create conditions which keep the plant healthy. Stress weakens the defense mechanisms of plants and makes them easy targets for pests and diseases. Focusing on plant management towards enhancement of its physiological activities also helps to reactivate plant's inherent quality of self- nourishment and self- protection, which in turn helps to minimize the incidents of pest/disease infestation and thereby effective control utilizing organic pest control alternatives.

*5.8. Are there any significant environmental benefits of organic farming?*

The environmental costs of conventional agriculture are substantial, and the evidence for significant environmental amelioration via conversion to organic agriculture is overwhelming. A review of over 300 published reports showed that out of 18 environmental impact, organic farming systems performed significantly better in 12 and performed worse in none (Romesh et al., 2005). But the biggest impact is minimization of pesticide and heavy metal residues in food chain which threaten the human health aspects.

*5.9. Is organic agriculture economically feasible?*

In theory, replacement of external inputs by farm-derived resources should lead to reduction in variable input costs under organic management. However, in most cases outsourcing of bulky organic inputs, in-effective pest control and huge production loss increase the cost of production. Also higher requirement of man-days under organic practice adds up the cultivation cost. Technological advances that can enable sufficient and timely on-farm resource generation and sustain crop productivity, can only cut down the production cost.

## 6. Constraints faced by the Indian organic growers

Despite efforts from government and other agencies, subsidies and other schemes, area under organic farming is still less than 1% of total cultivated area in India. The farmers adopting organic farming face difficulty to survive and market their end products.

*6.1. Absence of supportive policy*

The most important constraint felt in the progress of organic farming is the inability of the government to take a firm decision to promote organic agriculture.

*6.2. Loss of crop yield*

Farmers adopting conventional organic farming face huge losses i.e. upto 71%, in the initial years (Savage, 2016). Also the time required to achieve crop sustainability under present organic cultivation system is still unknown and thereby resulting in high cultivation cost and economic unviability. According to an USDA Survey, the organic yields were lower in 84% areas. The organic yield gap is predominant for row crops, fruit crops and vegetables.

*6.3. Non achievement of expected quality*

Most of the organic produce fail to achieve the desired intrinsic and extrinsic qualities as expected under organic cultivation, and thereby lose the consumer base.

*6.4. Failure of organic pest management*

Following the conventional cidal approach of pest management utilizing weaker organic pesticides cannot resolve the pest/disease issues in organic agriculture. And this forms the major reason for crop failure under organic.

*6.5. Shortage of biomass and livestock*

Conventional farming practices, increased mechanization and decreasing per capita land holding has led to scarcity of bio- resource for compost production that forms a major bottleneck towards large scale organic conversion.

*6.6. Lack of quality seeds supporting organic agriculture*

Hybrid seeds are designed to respond to fertilizers and chemicals. Presently Genetic and fertilizer sensitive seed and planting materials rules the market with negligence on indigenous varieties, which are more suited for organic farming. There is a large vacuum in the availability of quality organic seeds and forms a major constraint for the farmers willing to adopt organic farming.

*6.7. Lack of storage, transport &organized organic marketing system*

The challenge posed by inadequate agricultural infrastructure and cold storage facilities translate to loss of produce due to spoilage. Additionally, poor road infrastructure especially in the hilly States, results in poor and delayed connectivity to farmer markets.

*6.8. Vested interests of chemical and pesticide lobby*

The seed, fertilizer and pesticide industry as also the importers of these inputs to the country have a stake in the conventional farming and their opposition to organic farming is one of the biggest hurdle towards dissemination of organic farming.

*6.9. Lack of awareness and guideline for organic farming*

There is lack of adequate research and development backup as well as training related to Organic Farming in India. Most of the farmers in the country have only vague ideas about organic farming and its advantages as against the conventional farming methods.

*6.10. Inability to meet the export demand*

According to a study by Garibay and Jyoti (2013), Indian organic exports faces different constraints *viz*. high price expectations in relation to quality, inconsistent quality and residues, time consuming and complicated paper work etc. as result of the export demand is left unattended.

*6.11. Complexity and high cost of organic certification system*

Complexity regarding organic certification, high cost as well as time frame (3 years in most cases) forms one of the major constraints for small land holders.

*6.12. Scarcity and high cost for quality analysis*

There is scarcity of economic facilities for quality assessment of organic inputs and organic produce. As a result there is lack of quality mapping of most of the organic produce (especially for domestic market), which opens up the scope for spurious products in the niche organic market and thereby leads to the decrease in the consumer interest

Some Key Points

• 50.9 mha of agricultural land are under organic(Share of total agricultural land increased from 0.2 % in 1999 to 1.1% in 2015).

• Oceania has highest 45 % share of total organic area, out of which 97% are grassland.

• Increase of organic producers from 0.2 million in 1999 to 2.4 million in 2015 with highest number of producers in India (about 24 percent).

• Apart from agricultural land, 39.4 mha represent wild collection with 3rd highest area in India (3.71 mha).

• Cereals comprise highest area under organic cultivation (3.89 mha) followed by fodder (2.51 mha), oilseeds (1.24 mha), fruits (0.99 mha), coffee (0.90 mha), olives (0.67 mha), textile crop (0.45 mha), nuts (0.41 mha), pulses (0.40 mha) and vegetables (0.35 m ha).

• Source : Willer and Lernoud , 2017

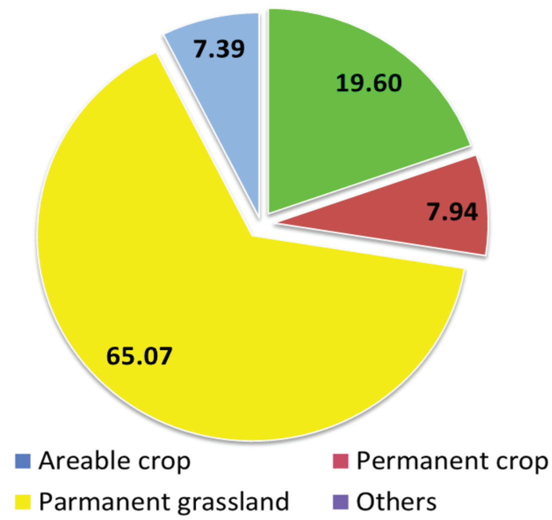



Figure 1: Distribution of Organic Land as per use type

towards organic products.

In a nutshell, there has been dearth of comprehensive organic farming practice/s which can ensure ecologically and economically sustainable organic crop production without any time lag. It is true that there is lack of proper infrastructure and government support towards organic marketing. But at the same time higher marketability cannot be achieved only in the name of organic. To make this a reality, we need to bring forth a comprehensive organic package of practice that is Safe, Effective, Complete, Convenient and Economical - the ‘Five Indispensable Criteria’ for delivering truly sustainable and large scale organic agriculture.

## 7. Overcome the Technological Challenges

### A. Case Study with IRF Organic Package of Practice

Inhana Rational Farming (IRF) Technology is based on the ‘Element Energy Activation’ (EEA) Principle (Chatterjee et al, 2014) which is inspired by the evolutionary concept of Vedic philosophy (Figure 2). IRF technology was first introduced as a complete organic package of practice in 2001 in tea and aims at developing Healthy Plants through:

(i) Energization of soil system i.e., enabling the soil to function naturally as an effective growth medium for plants (Barik et al., 2014a) and

(ii) Energization of plant system i.e., enabling higher NUE alongside better bio-chemical functions that leads to activation of the plants’ host defense mechanism (Barik et al., 2014b).

The Technology bears the essence of Trophobiosis theory and reaches to the root cause of pest interference and works towards amelioration of factors that favourably signal pest/disease advances (Seal et al., 2016).

Findings from FAO-CFC-TBI Project (2008-2012): According to the report of FAO-CFC-TBI Project ‘Development production

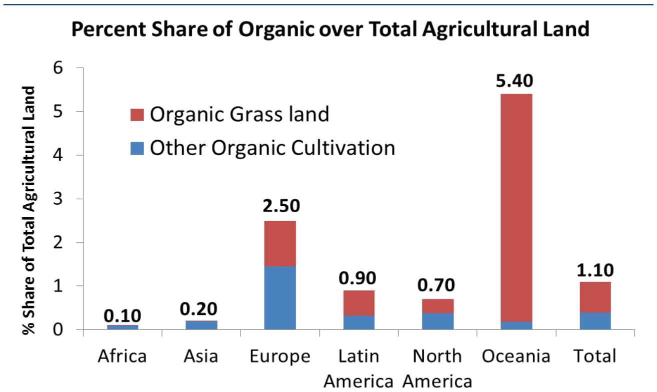



Figure 2: Percent share of organic over total agricultural land

and Trade of Organic Tea (2008-2012), a comparative evaluation was done among different organic methods/ Packages of Practice (POP) to develop an effective pathway for sustainable organic tea production. All available organic methods and combined package of practice (based on scientific rationale) were evaluated in terms of meeting target yield, soil development & finally in terms of economic viability.

The results indicated better performance of IRF organic package as compared to all other organic packages of practice (Table 2) in terms of crop productivity, cost of production and soil quality development (Bera et al, 2013).

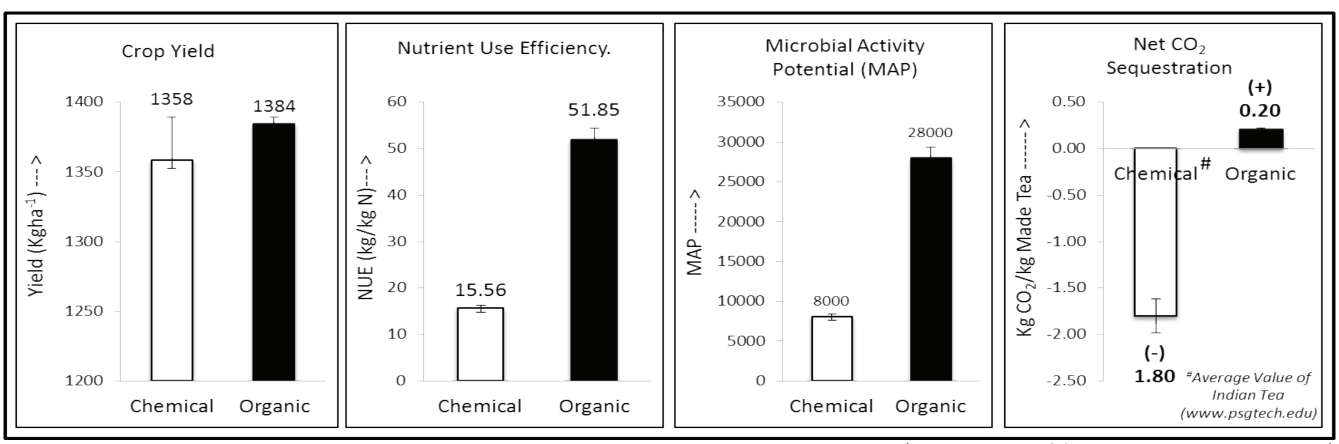
*7.1. Organic tea cultivation under IRF Technology at W. Jalinga T. E.*

Effectiveness of IRF Organic package of practice in organic tea cultivation is demonstrated in yield sustainability. Where more than 40 % yield loss under organic conversion is common in Indian tea, 10 years average under chemical and organic post conversion showed slight increase in crop productivity (Fig. 3) despite application of 1/3rd dose of N as compared to actual N harvested and 1/5th of what is applied under chemical. Activated soil –plant nutrient relationship was corroborated

Table 2: Ranking of different package of practice in terms of crop efficiency and cost $ha^{-1}$ for mature tea

| Rank | Package of practice | Yield (kg $ha^{-1}$) | Over target (1220 kg $ha^{-1}$) (%) | Cost $ha^{-1}$ (Rs.) | Cost $kg^{-1}$ (Made tea) | Soil development index (SDI) |
|---|---|---|---|---|---|---|
| 1. | IRF Technology for soil and plant management (IRF) | 1374 | 113.3 | 13,796 | 10.04 | 97.9 |
| 2. | Vermi Compost & Bio-fertilizer combination for soil management + Bio-pesticide for plant management (VMI) | 1299 | 103.5 | 66,257 | 51.01 | 79.7 |
| 3. | Vermi Compost for soil management + Bio-pesticide for plant management (VMIP) | 1235 | 98.9 | 46,832 | 37.92 | 63.47 |
| 4. | Vermi compost for soil management + Conventional organic Pest Management(VCO) | 1158 | 92.8 | 40,184 | 34.70 | 72.9 |
| 5. | Convention organic soil and plant management (CO) | 1109 | 89.2 | 12,954 | 11.68 | 80.5 |
| 6. | Biodynamic Farming soil and plant management (BD) | 1075 | 87.4 | 14,914 | 13.87 | 63.12 |
| 7. | Bio-fertilizer and Bio-pesticide for soil & pest management (MI) | 1065 | 86.2 | 28,657 | 26.91 | 53.39 |

Source: Project report of FAO-CFC-TBI Project at Maud T.E., Assam (2008-2012) (Anonymous, 2013)




(Source : World Science Congress, 2017)

Figure 3: Aspects of Organic Tea Cultivation under IRF Technology at W. Jalinga T.E., Assam

by the 233 % increase in nutrient use efficiency under IRF technology. Net $CO_2$ sequestration of 0.20 kg per kg made tea in West Jalinga was audited by Soil & More, an international organization accredited for carbon foot print estimation; as against average value of 1.80 kg $CO_2$ emission per kg made tea in India (SMI Newsletter, 2003).

*7.2. Organic agriculture under IRF Technology*

IRF Technology has been implemented in several agricultural crops *viz*. Paddy, baby corn, green gram, okra, potato and tomato; to study its effectiveness as compared to conventional farmers' practice in both research stations as well as farmers' field (Table 3). The interesting revelation from all the crop trials was higher crop productivity under IRF organic; that too from the very 1st year of intervention. Yield increase at 5.1 to 29.5% was documented in case of different field crops, which might be due to higher nutrient efficiency under organic. Similar trend was noted in case of energy use efficiency which was up to 120 % higher in case of organic; thereby indicating better potential for mitigation of GHG emission. Soil health indices *viz*. soil fertility index (FI), microbial activity potential (MAP) & soil quality index (SQI) showed increasing trend under organic.

Table 3: Comparative study of crop cultivation under IRF Organic & Chemical Farming Practice (Source : World Science Congress, 2017)

| Crop | Yield (Kg ha$^{-1}$) | NUE[1] | EUE[2] | Soil Health Indices | | |
|---|---|---|---|---|---|---|
| | | | | FI[3] | MAP[4] | SQI[5] |
| Paddy (Oryza sativa) [Variety : Gobindobhog, IET4786 ] | 3194* (2977) | 11.8 (24.8**) | 2.55* (2.07) | 24.1 (23.6) | 15.40** (11.20) | 0.54* (0.47) |
| Baby Corn (Zea mays) [Variety : HM 4] | 1700** (1333) | 8.1* (6.7) | 1.29* (0.80) | 20.2 (20.7) | 13.43* (10.12) | 0.46* (0.41) |
| Green Gram (Vignaradiata) [Variety : PDM 84-139] | 933* (819) | 6.95 (8.19*) | 2.12* (1.77) | 26.5 (26.2) | 18.12* (16.24) | 0.59 (0.56) |
| Tomato (Lycopersiconesculentum) [Variety : Rituraj] | 35000** (31000) | 129.6* (110.7) | 2.07** (0.98) | 25.9 (26.3) | 20.13* (17.22) | 0.64* (0.58) |
| Potato (Solanumtuberosum) [Variety : Jyoti] | 30000* (27750) | 111.1** (79.2) | 4.56** (2.07) | 28.7 (29.4) | 22.04* (19.06) | 0.63 (0.59) |
| Okra (Abelmoschusesculentus) [Variety : hybrid Shakti (F1)] | 7793* (6860) | 36.59* (27.55) | 2.02* (1.72) | 23.4 (23.9) | 14.43* (10.27) | 0.51** (0.43) |

Note : Figure in the parenthesis represents data from chemical farming; T – test (* significant at P<0.05 and ** significant at P<0.01); 1NUE : Nutrient Use Efficiency (kg/kg produce); 2EUE : Energy Use Efficiency; 3FI : Fertility Index; 4MAP : Microbial Activity Potential; 5SQI : Soil Quality Index (Bera et al., 2015)

*7.3. Organic Seed Development Under IRF Package of Practice*

Different indigenous aromatic and popular variety organic paddy seed development in different agro-ecosystem of gangetic-alluvial, coastal saline and arid red soil has been initiated with IRF Technology. Initial reports (Table 4) from coastal saline zone suggest the production of high quality organic seeds under this technology.Sustainable crop performance under IRF Technology corroborates

Table 4: Indian Seed Certification Standard *vis- a- vis* Seeds produced at Block Seed Farm, Canning, West Bengal (Source : Canning Report, 2017)

| Factor | Standards for each class | | Seeds developed in Canning | | |
|---|---|---|---|---|---|
| | Foundation | Certified | Banskathi | Dudheshwar | PAN 802 |
| Pure seed (min.) | 98.0% | 98.0% | 99.85 % | 99.88% | 99.92% |
| Inert matter (max.) | 2.0% | 2.0% | 0.15 % | 0.12 % | 0.08% |
| Huskless seeds (max.) | 2.0% | 2.0% | No | No | No |
| Other crop seeds (max.) | 10/kg | 20/kg | No | No | No |
| Total Weed seeds (max.) | 10/kg | 20/kg | No | No | No |
| Germination (min.) | 80% | 80% | 92 % | 92 % | 98 % |
| Moisture (max.) | 13.0% | 13.0% | 9.32 | 12.00 | 9.77 |

higher resource use efficiency, better plant functioning and harmonization in soil-plant-ecology interdependence. The finding endorsed positive influence of the potentized and energized botanical solutions as used for plant management under IRF; towards plant metabolic functions leading to efficient nutrient utilization and thereby enhancement of crop yield potentials (Seal *et al*, World Science Congress, 2017).

## 8. Future of Organic Farming in India

India is poised for faster growth with the growing domestic market. Success of organic movement in India depends upon the growth of its own domestic markets. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in the world's organic market. With this growing demand more and more technological innovation like IRF Technology and their implementation in farmers'field will ensure economically viable organic agriculture and help in its adoption by the common farmers even without any subsidy scheme or guaranteed premium price. Considering the increasing awareness about the safety and quality of foods, long term sustainability of the system and accumulating evidences of being equally productive, the organic farming has emerged as an alternative system of farming which can not only address the quality and sustainability concerns, but also ensure a debt free, profitable livelihood option.

## 9. Conclusion

Ecologically and economically sustainable organic farming is the pre-requisite for enabling wider adoptability, secured livelihoods and ensuring affordability at the consumer's end. India has a rich history of organic farming and the increasing domestic market of organic food can provide the necessary drive to the organic movement. Awareness program at both the consumer and farmers' level is necessary for bringing about large scale organic conversion. But most importantly innovative organic farming technologies like Inhana Rational Farming (IRF) can popularize the practice even among the resource poor farmers by ensuring ecologically and economically sustainable organic crop production in a time bound manner. Case studies of IRF Organic Practice also testify the corresponding GHG mitigation and adaptation potential as reflected in the high carbon sequestration, soil resource regeneration, high energy use efficiency as well as development of plant resilience; but the highlight remains its cost effectiveness and time bound results.

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