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FARMERS PARTICIPATORY PROGRAM FOR DEVELOPMENT OF CLEAN FOOD THROUGH ADOPTION OF AN INNOVATIVE FARMING TECHNOLOGY AT NADIA DISTRICT, WEST BENGAL, INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Authors RB, AS and SHA developed the study protocol. Authors RB, KM, MD, Susmita Saha and AD led farmer's training and awareness program, farmers' survey while authors Susmita Saha, Saikat Saha, MKK, SJP, SCD and SI monitored the project, did the documentation and performed the statistical calculations. Author AS managed the literature searches and wrote the first draft of the manuscript. All authors have read and approved the final manuscript.

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ABSTRACT

Production of food in a safe and sustainable manner has become crucial to meet the global food security, without harming the environment and ensure ecological preservation especially in the backdrop of the climate change impact. To attend the objective of safe and sustainable crop production, Inhana Organic Research Foundation, (Kolkata) has initiated the 'Clean Food Movement' in collaboration with Nadia Krishi Vigyan Kendra, ICAR, BCKV. Inhana Rational Farming (IRF) Technology- a comprehensive organic package of practice has been introduced as the major interventional agri-technology along with other techniques/ good agricultural practices, for the purpose of 'Clean Food' development. Clean food is a food segment that is produced without the use of carcinogenic pesticides (especially Class-I & Class –II), antibiotics, steroid, growth promoters, etc. The safety of the clean food will be ensured by the Clean Food Standard (CFS) Certification through qualitative colorimetric assay test for pesticide residues. Clean food movement will probably be the first ever initiative towards Healthy Life & Farmers' Empowerment that will bring forth pesticide- free clean food at an affordable price structure.

Keywords: Clean food; plant health management; farmers awareness; organic concoctions; farmers producer company; clean food standard certification.

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1. INTRODUCTION

The world is facing unprecedented challenges that affect the sustainability of food and agriculture systems and the livelihoods of smallholders and family farmers worldwide [1]. These problems include depletion of vital resource and adverse impacts on environment and loss of biodiversity. The situation has become further complex with the climate change impact along with ever-increasing world population. Collectively, these challenges pose serious threats to food security. Hunger and chronic undernourishment are on the rise and preventable foodborne diseases continue to affect millions annually. Furthermore, there are projections that, by 2050, the growing world population may require twice as much food as was produced in 2012 [1].

In the quest for safe and sustainable crop production, Inhana Organic Research Foundation, (Kolkata) initiated the Clean Food Movement in collaboration with Nadia Krishi Vigyan Kendra, ICAR, BCKV. Inhana Rational Farming Technology, which is a comprehensive organic package of practice [2] developed by Dr. P. Das Biswas Founder Director, IORF [3] is the major interventional agro-technology towards reduction of chemical pesticides and nitrogen fertilizers for production of pesticide free safe food i.e. 'Clean Food'.

Clean Food Movement will not only help farmers to gradually reduce the dependency on chemical inputs and incline towards a safe and sustainable pathway of crop production but also ensure the authentication of the end product through analysis, as well as a unique certification process. The process shall be completed through development of a direct supply chain of the safe and sustainable food product from the producers to the consumers; at a lower price as compared to the market price of conventional food product. The objective is to supporting farmers' livelihood by ensuring proper price while enabling safe product for the consumers at a sustainable price.

2. MATERIALS AND METHODS

Inhana Organic Research Foundation, Kolkata has initiated the Clean Food Movement in collaboration with Nadia Krishi Vigyan Kendra, ICAR, BCKV from June, 2020 at Haringhata Block, Nadia District, West Bengal. The movement has started with training and awareness program in seven selected villages in the study area (Fig. 2).

2.1 Climatic Data of the Study Area

The area belongs to hot, moist subhumid ecological sub region (15.1) [4]. The climate of the study area is characterized by oppressively hot summer, high humidity and high rainfall during the monsoon. Winter starts from the middle of November which continues up to the end of February. As per the last five years climatic data base, it received about 1300 mm annual rainfall. The maximum i.e. 110.4 to 289.6 mm is received during April to October which is about 94% of annual rainfall. The highest mean monthly temperature is observed in the month of May (33.6°C) and the lowest (16.2°C) in the month of January (Table 1).

Table 1. Five years average climatic data (2016 -2020) of the study area

Months	Max Temp (°C)	Min Temp (°C)	Rainfall (mm)	No of rainy days	Humidity %	Cloud %	Total sun hours	Sunny days
January	26.6	16.2	4.8	1.8	43.6	6.4	240.6	29.4
February	30.6	19.6	25.4	3.0	40.6	11.2	222.6	25.0
March	34.8	22.8	25.7	7.0	46.0	14.8	293.4	21.4
April	38.6	27.0	110.4	12.4	55.4	24.8	277.4	12.6
May	38.6	28.2	125.4	14.0	58.4	23.2	340.2	13.4
June	37.0	29.0	122.8	23.4	63.8	46.8	286.5	5.4
July	34.0	27.4	250.5	29.2	74.0	56.8	218.4	1.0
August	33.0	27.0	289.6	28.6	78.6	53.4	230.2	2.2
September	32.6	26.4	194.2	24.2	77.6	46.4	209.6	5.0
October	31.8	24.0	111.9	14.6	70.4	29.6	254.5	15.6
November	30.0	21.0	18.3	2.6	55.0	10.8	280.2	27.0
December	26.8	17.4	4.3	1.6	48.2	11.4	221.8	29.2

The difference between mean summer temperature (MSST) and mean winter temperature (MWST) is more than 5°C. Thus the soil temperature regime qualifies for 'hyperthermic'. The mean monthly relative humidity ranges from 40.6 to 78.6 percent. Highest number of rainy days was in July (29.2 days) closely followed by August (28.6 days) which means it rained almost every day during these months. Average sunshine hour was highest in the month of May (10.97) whereas highest number of Sunny Days was in January (29.4 days) (Fig. 1).

2.2 Physiography and Soils of the Study Area

In terms of physiography, the study area belongs to riverine delta zone and is formed by the materials carried by the Ganga. The area was basically under Meander flood plain. According to Soil Survey Staff [5] the soils of the study area was very deep, imperfectly drained fine loamy soils occurring on level to nearly level meander plain with loamy surface and moderate flooding associated with very deep, moderately well drained fine silty soils. Fine loamy Fluventic Ustochrepts and fine silty Typic Ustifluvents are the major soils in association (Pic. 1).

2.3 Inhana Rational Farming (IRF) Technology

Inhana Rational Farming Technology (IRF) is a comprehensive organic POP aiming at restoration of soil and plant health that simultaneously deflates pest pressure due to alleviation of factors responsible for pest –parasite interactions [6]. The package works towards (i) Energization of soil system i.e., enabling the soil to function naturally as an effective growth medium for plants and (ii) Energization of plant system i.e., enabling higher nutrient use efficiency alongside better bio-chemical functions that leads to activation of the plants' host defense mechanism [7].

Soil energization aimed at rejuvenation of soil microflora, is primarily attended by application of on-farm produced Novcom compost (that contains rich population of self-generated micro flora in the order of 10^{16} c.f.u.) [8]; different types of herbal concoctions and adoption of cultural practices. However, the technology emphasizes plant health management as a precursor for resilient plant system that can ensure sustainability even under changing climatic patterns. Plant health management under this technology is a systemic approach that utilizes a set of potentized and energized botanical solutions developed on the Element Energy Activation (EEA) Principle [9].

According to EEA Principle, radiant solar energy is stored in plants and the bound or stored energy components from energy rich plants are extracted on specific day an time, by specific extraction procedure and subsequently potentized so that energy components can be effectively received by plant system towards activation of various metabolic functions (Fig. 3). Each solution has one or more defined functions, but work in an integrated manner when applied in a schedule, for bringing about harmonized plant growth with ensured aggregation of biological compounds responsible for flavour, nutrition and medicinal properties [10].

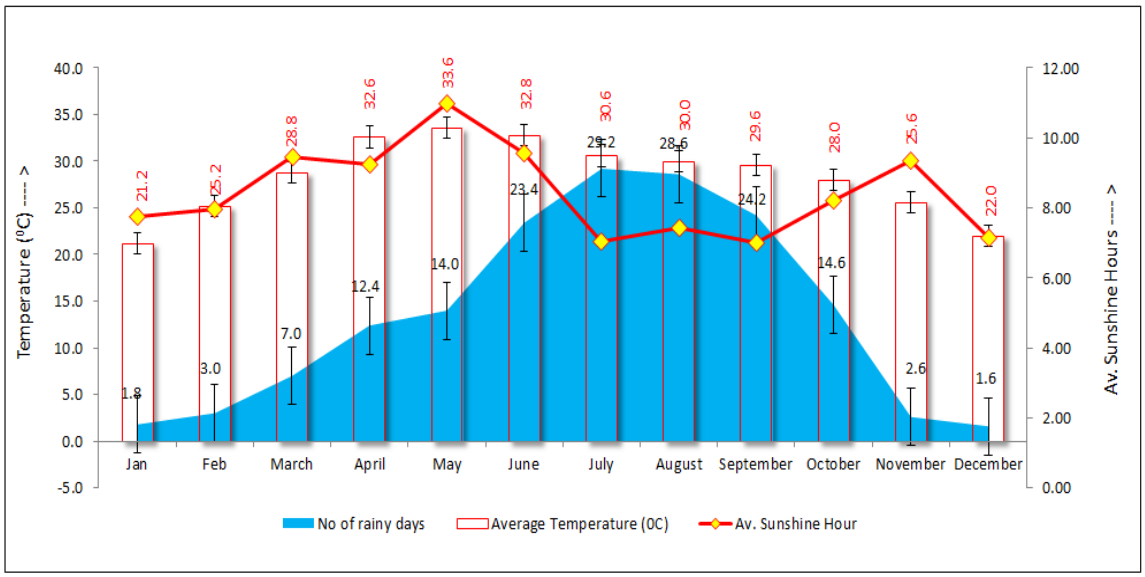

Fig. 1. Multivariate study of mean temperature, avg. sun shine hours and no. of rainy days

Pic. 1. Vegetable cultivation landscape in the study area

No	Village	Area (ha)	Population	Per capita land
1	Satyapole	165.04	1575	0.10
2	Bansbona	119.99	1680	0.07
3	Atbehariya (Behara)	251.4	2672	0.09
4	Bhabanipore	116.49	793	0.15
5	Dhopgachi	49.91	474	0.11
6	Panchkahania	138.11	1400	0.10
7	Srikrishnapur	148.13	1976	0.07
	TOTAL	**989.07**	**10570**	**0.09**

Fig. 2. Catchment area under clean food movement

Pic. 2. Field visit by project scientists in the study area

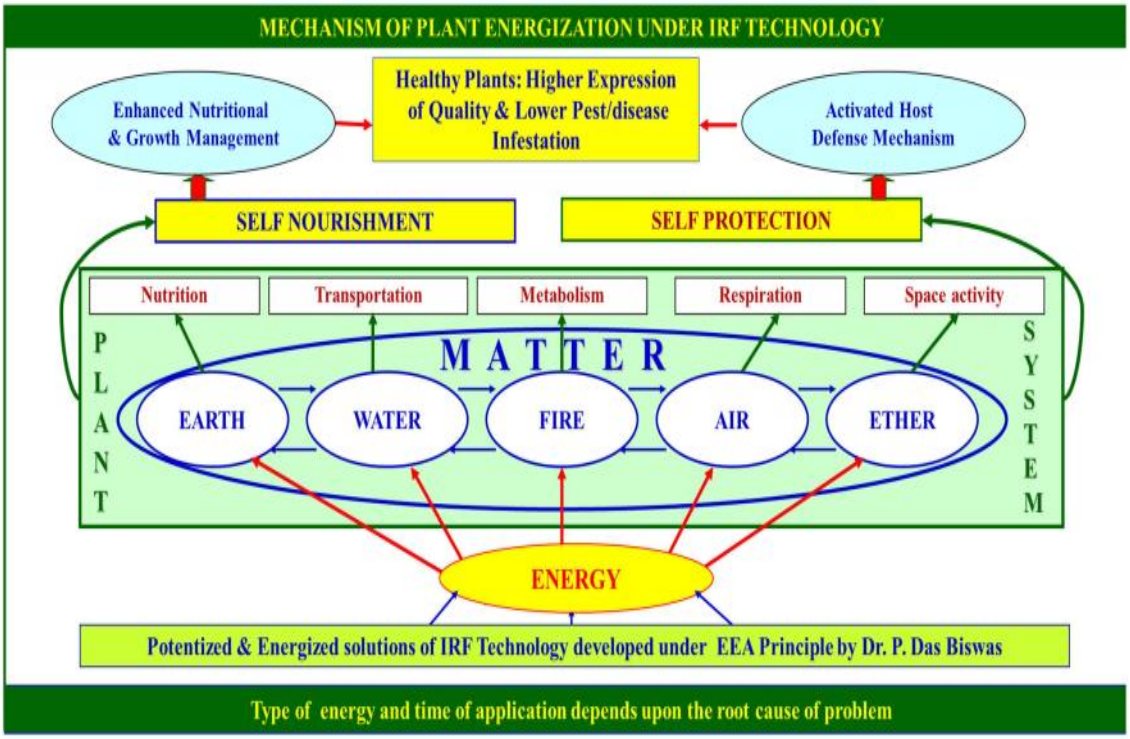

Fig. 3. Role of different energy on plant functioning

2.4 Clean Food Development

Inhana organic research foundation (IORF) from its commitment of 'Pure food for all' has initiated the '**Clean Food Program**' to produce **Pesticide Free End Product**. Clean Food is the First and the Only Offer in the direction of Safe & Sustainable Food that will enable large scale Safe Food production and ensure producers' profitability while bringing value added product for the consumers at affordable pricing. Clean Food will be produced without the use of harmful chemicals i.e., pesticides (Especially Class-I & Class –II), antibiotics, steroid, growth promoters, etc. – which have become the biggest threat towards Health Safety of the common people post green revolution.

Pic. 3. Farmers meeting conducted at Bhabanipore Village, Nadia; by Nadia KVK & IORF (Kolkata) under the 'Clean Food' program

2.5 Science behind Clean Food Production

Development of Clean Food is based on a simple scientific hypothesis that relationship between Plant and Pest is purely nutritional. The life time research of F. Chabassu showed that application of chemical fertilizers, especially N-fertilizers along with depressed plant metabolism enhance free amino acids and free sugar pool in the plant cell sap which is the ready food for the pest [11]. So if pesticide usage is to reduce, then first pest need to be reduced and for that the ready food source need to be cut off. The Unique Approach under IRF Technology is based on this scientific background, and serves to activate Plants' Metabolism & Photosynthetic Efficiency in order to curtail the accumulation of ready food source for the pests in the plants' cell sap, so as to curtail the pest infestation and thereby the dependency on chemical pesticides. This primary approach along with some pest management alternatives serves towards elimination of the risk of pesticide residues in the end product i.e., 'Clean Food'.

2.6 Clean Food Movement: Farmers' Program in Brief

- Farmers' training programme.
- Soil testing.
- Swot analysis
- Development of resource maps.
- Crop & problem specific customized solution:

i. Seed / Planting Material Treatment Package.
ii. Nursery/ Seed Bed Mgt. Package.
iii. Crop Specific Customised Plant Health Mgt. Package.
iv. Solutions for Compost Preparation.
v. Disease Mgt. (through Plant Health Mgt.) Package.
vi. Solutions for On-farm Concoction Preparation

- On-farm resource recycling & soil Mgt.
- Monitoring & supervision.
- End product quality & residue assessment.
- Preparation of scientific documentation.

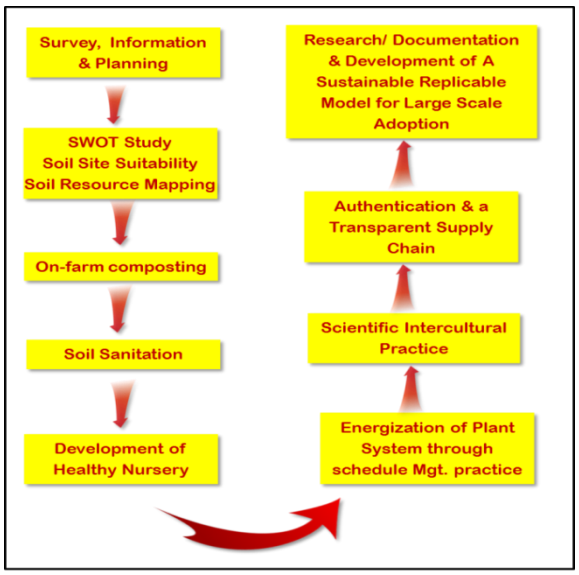

Fig. 4. Flow diagram of activity in the study area in Haringhata Block, Nadia

Pic. 4. Farmers' meeting at Satyapole Village, Nadia towards production of 'Clean Food'

Table 2. Awareness level (%) of the farmers regarding the risk associated with the chemical inputs in agriculture

Sl. no	Questioner	Yes	Sometimes/Very Little	No
1.	Do you know about toxicity (LD_{50} value) of the pesticide used?	0.00	13.13	86.88
2.	Do you know the prescribed dosage of the chemicals used?	1.88	13.13	85.00
3.	Do you know about Pre harvest interval of chemicals used?	1.88	13.13	85.00
4.	Do you know about Re-entry periods after spraying?	50.63	41.88	7.50
5.	Do you smoke during the interval of spraying	31.25	52.50	16.25
6.	Do you take food during the interval of spraying?	15.63	30.63	53.75
7.	Do you wear protective gear during spraying	10.63	40.63	48.75
8.	Do you dispose pesticide container at a specific place?	23.13	40.63	36.25
9.	Do you wash chemical container yourself, wash in the pond or other water body?	68.75	28.75	2.50
10.	Do you keep the chemical container safe from children?	91.25	8.75	0.00
11.	Do you know about the ingredients of the pesticides?	1.25	16.25	82.50
12.	Do you know about compatibility of different pesticides?	35.00	43.13	21.88
13.	Do you maintain any gap (more than 7 days) between pesticide spray and harvesting?	3.13	11.88	85.00
14.	Do you know the impact of chemical pesticide on Soil Health?	11.88	63.75	24.38
15.	Do you know the threat of chemical usage on Environmental Degradation?	46.25	36.88	16.88
16.	Do you know the threat of chemical contamination in drinking water?	13.13	35.00	51.88
17.	Do you know the risk of direct exposure while spraying pesticides?	8.13	48.75	43.13
18.	Do you keep records of your chemical usage	5.00	17.50	77.50
19.	Do you believe that pesticides increases crop productivity?	80.63	16.88	2.50
20.	Do you believe excess pesticide usage weaken Plant Health?	11.88	24.38	63.75

3. RESULTS AND DISCUSSION

To develop clean food, the selected area was surveyed and group discussion with the farmers in different locality was done for the first six months. During this time awareness and training programs were also organized and a survey was done a per prescribed format to find out the general awareness of the farmers regarding the usage of chemicals and its impact on human health, surrounding ecology and risk of food toxicity. Data was also generated regarding major crop cultivation, their productivity and major problems, general crop calendar and other agriculture related problems (Pic. 3 & 4).

3.1 Awareness Level of Farmers in Relation to Chemical Pesticide Usage

A Survey was conducted among the local farmers to understand their awareness level regarding the use of agro-chemicals and its impact on food toxicity, human health and environmental degradation. About 65% people were found to have very low level of awareness in terms of the nature of chemical pesticides and their usage protocol, which enhances their threat of exposure to pesticide toxicity to a great extent (Table 2).

Awareness regarding the impact of chemical pesticides towards crop sustainability was also found to be low among a major (about 62%) section of the farmers (Fig. 5) More than 80% of the farmers viewed chemical pesticides as the most important component for enhancing crop productivity and are therefore highly dependent on it (Fig. 6). Absence of proper guidelines and the lack of effective pest control under alternative pest control options have created confusion among the farmers regarding the importance of non-chemical pest management towards crop sustainability. And due to the lack of science based nature friendly cultivation process that can deliver sustainability without the dependence on off- farm inputs, the farmers have refrained from moving over to sustainable practices.

In respect of the impact of pesticide use on human health, about 34% farmers were found to well aware; another 34% had some awareness regarding the risk associated with the handling of pesticides, while about 33% farmers were careless in respect of the associated safety protocols (Fig. 7). Survey on awareness regarding the impact of chemical pesticides on soil and the surrounding ecosystem revealed a fair amount of knowledge regarding the negative impact among 21% farmers while 35% farmers had some level of awareness (Fig. 8). A considerable number of farmers were found to be somewhat worried regarding the health of their farm land. But due to absence of soil testing and most importantly lack of advisory facility that can provide test based guidance, the farmers have not been able to take up any soil health management activities. However, it was clear from the survey that despite different level of awareness regarding the negative impact of chemical pesticides on soil, human health and the environment, the farmers of this area have continued the conventional farming practice due to lack of effective- nature friendly pathways, as well as their inherent lack of inertia.

Pic. 5. On-field Farmers' Meeting in the study area towards pesticide free crop Production

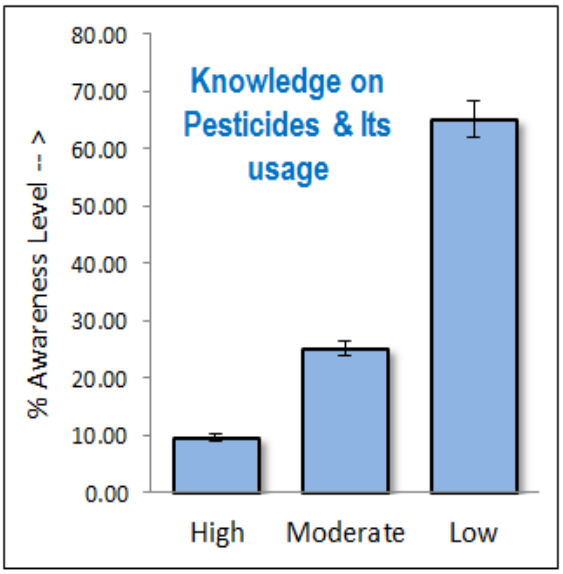

Fig. 5. Awareness level of local farmers regarding nature & toxicity of chemical pesticides and protocol for spraying

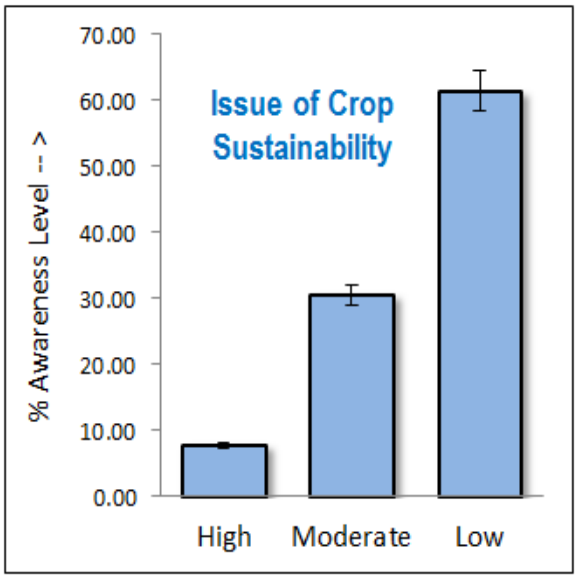

Fig. 6. Awareness level of local farmers regarding the impact of pesticides towards crop sustainability

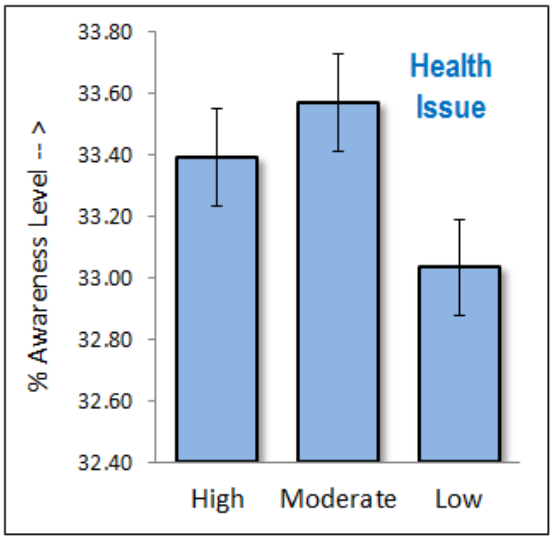

Fig. 7. Awareness level of local farmers regarding risk of exposure of chemicals on human health

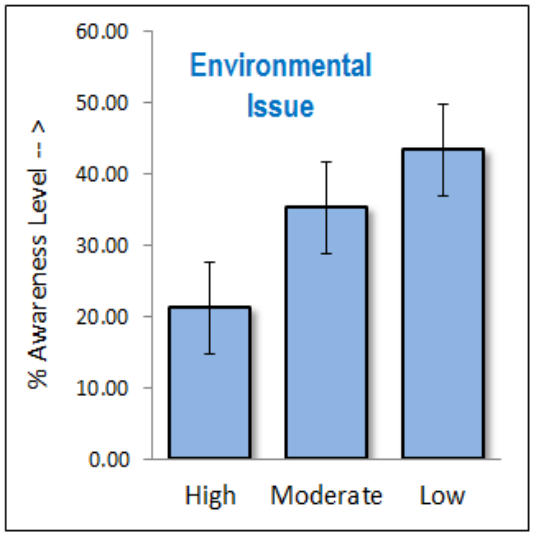

Fig 8. Awareness level of local farmers regarding impact of chemical pesticides on environmental degradation

3.2 Incorporation of Good Agricultural Practices in the Study Area

Second round of survey was done in the study area to know the different aspects of crop production and management in the study area. Questionnaire was set to evaluate four basic aspects of cultivation *viz*. (i) Adoption of good agricultural practices, (ii) Adoption of nature friendly cultivation practices, (iii) extent of technology transfer in agriculture and (iv) influence in cultivation practice (Table 3).

The study reveals that a good percentage of farmers are now slowly adopting new techniques and good agricultural practices which might have been influenced by the closeness of this area to the State Agricultural University (BCKV) and Krishi Vigyan Kendra (Nadia KVK). However, about 25% farmers are still behind in this aspect, which calls for an extensive farmer orientation program in the study area. And in terms of adopting nature friendly practices, about 80% farmers are now gradually gravitating towards such practices (Fig. 9).

Discussion with farmers have also revealed that despite awareness regarding the limitations of chemical farming, especially its negative impact on soil, the farmers have not been able to undertake sustainable practices due to lack of effective guidelines that can ensure crop yields, as well as absence of marketability options for the sustainable end products.

In terms of technology transfer, the ground reality is not as per expectation, considering that more than 57% farmers have not acquired the benefits of any new agricultural technology (Fig. 11).

More and more extension programs and better marketability options are necessary for motivating the farmers to adopt new technologies towards crop sustainability and environmental preservation.

The survey indicated another grim reality. Despite the presence of agricultural universities and KVK's; most of the farmers are still influenced by local agricultural dealer and private agro-company personnel in respect of seed procurement and chemical pesticides. Only a handful of farmers have linkage with government platforms/ or are guided by the state/central agricultural universities in decision making related to agriculture.

3.3 Constrains Perceived by Farmers

Another round of survey was done to evaluate the major constraints perceived by the local farmers in relation to crop production. The major emphasis is on produce marketability as more than 85% farmers complained about not getting actual price for their end products and the economic loss suffered due to the fluctuating market price. Apart from this, increasing problem of pest/diseases, unpredictable weather and non-availability of labour were most pertinent issues. Non- availability of quality seeds and overall hike in cultivation cost was also found to be a major cause of concern for many farmers (Fig. 13).

Table 3. Different components of crop production and management in the study area

Sl. no	Questioner	Yes	Sometimes/Very Little	No
1.	Selection of seeds as per dealers choice	51.88	28.13	20.00
2.	Preserve own seeds	18.75	37.50	43.75
3.	Do you follow seed treatment	6.88	15.00	78.13
4.	Soil testing of your land	5.63	18.75	75.63
5.	Follow the recommended NPK application	2.50	13.75	83.75
6.	Use of Neem Coated Urea	13.75	37.50	48.75
7.	Attend the Awareness and Training program of KVK/University or any Government Body	72.50	15.00	12.50
8.	Use organic manure in the land	11.25	57.50	31.25
9.	Manual Weed management	10.00	75.00	15.00
10.	Follow crop rotation planning	23.75	70.00	6.25
11.	Follow trap cropping, pheromone trap and other alternate pest management method	45.00	42.50	12.50
12.	Follow neem oil / bio-pesticide and other organic pest management options	11.88	75.00	13.13
13.	Use of Herbicides	36.25	63.75	0.00
14.	Prepare organic manure / compost in the farm	56.25	37.50	6.25
15.	Purchase organic manure/compost	26.88	61.25	11.88
16.	Document your cultivation record	6.25	32.50	61.25
17.	Can identify pest in the field	70.63	23.75	5.63
18.	Can identify disease in the field	56.25	36.25	7.50
19.	Purchase chemicals as per suggestion of dealer/distributer/ company representatives	71.25	26.25	2.50
20.	Purchase chemicals as per suggestion of University/ KVK/ other government representatives	2.50	45.00	52.50
21.	Use of improved nursery management technique	55.00	31.88	13.13

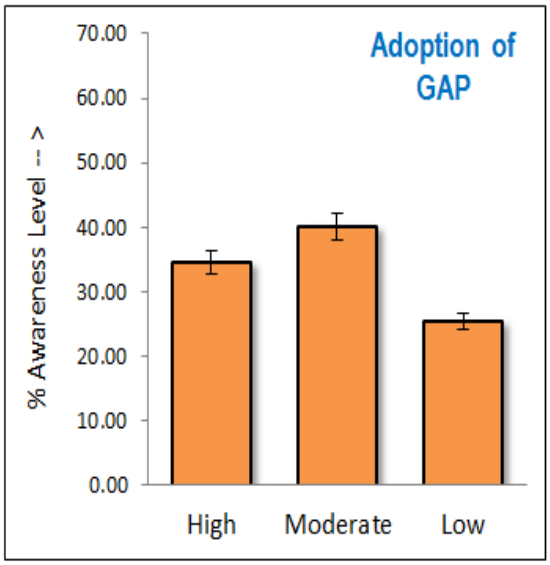

Fig. 9. Awareness level of local farmers regarding adoption of Good Agricultural Practice in the study area

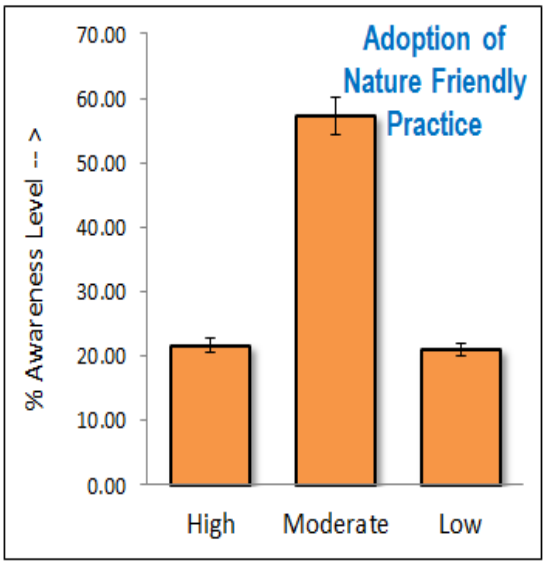

Fig. 10. Awareness level of local farmers regarding adoption of nature friendly agricultural practice in the study area

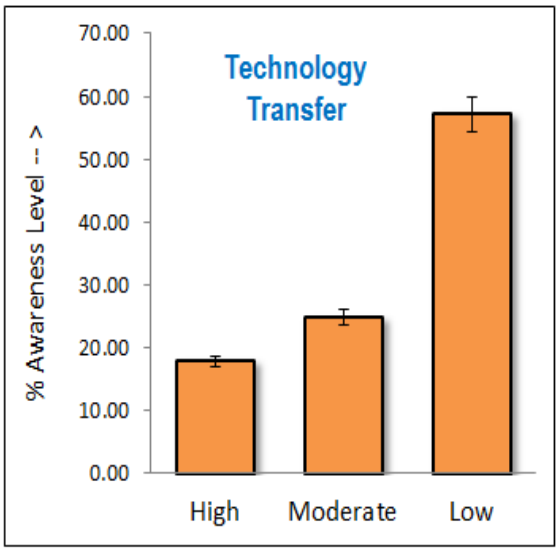

Fig. 11. Awareness level of local farmers regarding Technology transfer from the concerned agricultural institution/ authority

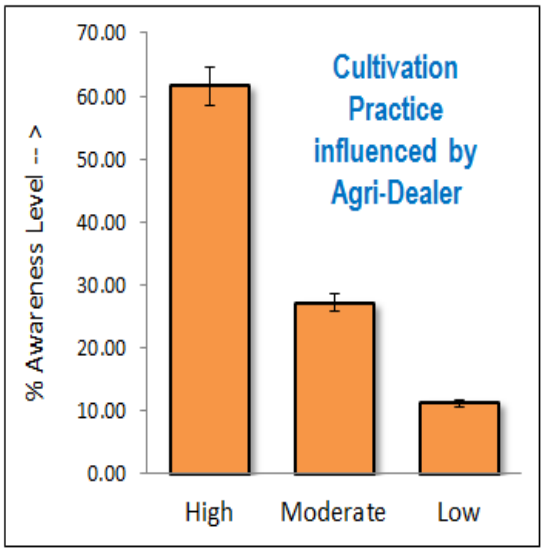

Fig. 12. Influence of local agri-dealers and private company representatives on management decisions of local farmers regarding cultivation practice

3.4 Activity Initiated in the Study Area towards Development of Clean Food

'Clean Food Movement' was initiated in the early part of 2020 by Inhana Organic Research Foundation in collaboration with Nadia Krishi Vigyan Kendra in the Haringhata Block of Nadia district, West Bengal. In the background of the Covid pandemic, awareness program was initiated with small scale on-field farmers' interactions and within six months more than fifty such interactions were done in the area. This was gradually followed by training programs, on-field demonstration of organic- concoctions, introduction of organic plant health management under IRF Technology and scientists from both the organizations participated in those meetings/ programs.

Pic. 6. Training program on nature friendly pest/disease management by IORF & Nadia-KVK Scientists

Pic. 7. Training Program on organic soil management by IORF & Nadia-KVK scientists

Pic. 8. Mixed cultivation practice in the study area

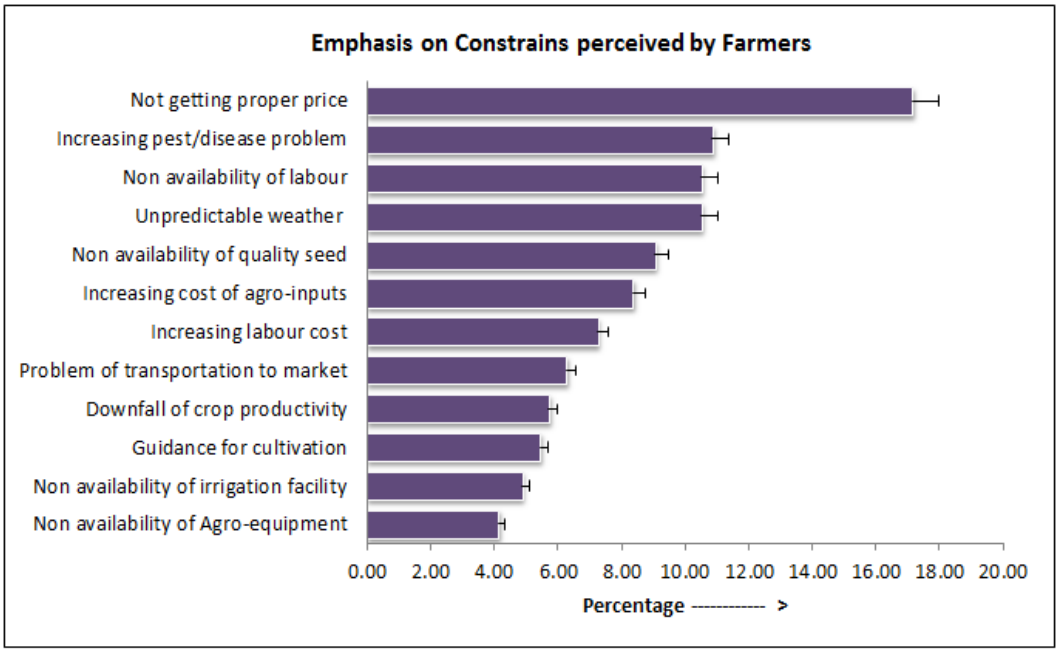

Fig. 13. Constraints perceived by the local farmers in the study area

3.5 Awareness and Training Programs

A number of awareness and training programs has been organized in the area towards motivating the local farmers in respect of adopting nature friendly cultivation practice that can enable pesticide free 'Clean Food' production. Scientists from both Nadia KVK (ICAR) and IORF demonstrated the different aspects of soil health management and techniques of nature friendly pest/disease management.

3.6 Soil Sampling and Analysis of Soil Quality

Soil samples were collected from the selected village on grid basis (Pic. 9) for soil quality analysis as per the operational guidelines of the Department of Agriculture & Co-operation under the Ministry of Agriculture [12]. Soil samples were drawn in a grid of 2.5 ha with the help of GPS tools and village maps. Analysis of soil samples were initiated in the laboratory of IORF and Nadia, KVK. Apart from the scheduled 12 parameters study i.e., N,P,K (Macro-nutrients); S (Secondary- nutrients); Zn, Fe, Cu, Mn, Bo (Micro - nutrients); and pH, EC, OC (Physical parameters), emphasis was given on the soil biological parameters viz., soil microbial respiration, microbial biomass, FDAH, qMBC, qCO_2; which is perhaps a first such study in India.

3.7 Initiation of Plant Health Management

One of the most important component of the 'Clean Food Program' is plant health management. Organic plant health management was adopted in the study area under Inhana Rational Farming (IRF) Technology towards development of healthy plants. It was initiated with organic seed treatment. Under the program, IRF seed treatment solutions were distributed among the farmers and the seed treatment method was demonstrated in front of the project farmers (Pic. 10 & 11).

Apart from organic seed treatment, a series of organic solutions was also distributed among the project farmers for application at the different plant growth stages; as per IRF Plant health management schedule. This schedule is oriented towards the development of healthy plants that is crucial for sustenance of crop yields and activation of plant immunity and host defense mechanism to reduce / eliminate the requirement of chemical pesticides and fungicides.

3.8 On-field Demonstration of Organic Concoctions

On-farm concoction preparation techniques was demonstrated in the study area. Inhana cow dung slurry (CDS) concoction is an effective combination of cowdung, cow urine and jaggery and used as foliar nutrient supplement, bush sanitation and as an inhibitor of pest infestation. Inhana CDS solution (IB-15) was added for speedy degradation of the organic ingredients and preparation of the concoctions within 5 days (Pic. 12).

Pic. 9. Collection of soil samples from farmers' field

Pic. 10. IRF Plant management solutions were distributed among project farmers under Clean Food Program

Pic. 11. Organic seed treatment using inhana seed treatment solution under clean food program

Pic. 12. Steps for preparation of CDS Concoction under Clean Food program for Plant Health Management under IRF Technology

3.9 Initiative for Standardization of Low Cost Qualitative Assay Test for Pesticide Residue

Analysis of pesticide residue in the end product in a regular batch wise manner is the only way out to authenticate clean food. However, high cost of the conventional HPLC study for determination of pesticide residue is the primary hindering block for conducting such study on a regular basis. Considering such limitation, different countries in the world have already identified alternative qualitative methods towards detection of pesticide residue in the food products. Inhana Organic Research Foundation in collaboration with Nadia Krishi Vigyan Kendra (KVK) has taken up the initiative to detect major groups of pesticides through low cost colorometric assay test. This will perhaps be a first such program, pan India.

3.10 Initiative for Development of Clean Food Standard (CFS) Certification

To ensure clarity and transparency at the consumer level, it is extremely important to recognize and authenticate farms/ farmers that have undertaken, sustainable farming practice towards pesticide free clean food production. An initiative has also been taken up under the clean food movement to develop an analysis backed certification system that will assist the farmers in better marketability of their clean food and establish a transparent consumer connect.

3.11 Development of a Farmers Producer Company (FPC) for Value Added Marketing of Clean Food

To ensure actual price of the 'Clean food' and thereby ensure secured livelihoods for the project farmers; a farmers-producer company (FPC) called 'Manobjomin Agro producer Company Limited' has been developed under the Ministry of Corporate Affairs. The FPC was developed by the local farmers with patronage of Inhana Organic Research Foundation (IORF), Kolkata and Nadia Krishi Vigyan Kendra (ICAR). The FPC was created with the sole objective of promoting the 'Clean Food Movement'. The FPC will work towards developing awareness among the farmers regarding adoption of nature friendly agricultural practice towards reducing the dependency on chemical inputs in order to render food safety and environmental preservation. About 250 farmers have joined and following the recommended practice for the 1st phase of clean food development.

3.12 Possible Outcome of the Clean Food Program

The 'Clean Food Movement' is a program for 360 degree care of the farming community. The possible outcomes are as follows:

- Ensure enhancement of Food Productivity: Clean Food Program will help to enhance crop productivity by up to 30% (*as validated through actual field trials*) through the adoption of a comprehensive farming practice i.e., IRF Technology.
- Reduce requirement of External Inputs: Clean Food Program will gradually reduce the requirement of external inputs and thereby recover the farmers from financial distress.
- Reduce Cost of Crop Production: This program will reduce the cost of cultivation through better resource utilization, technological support, reduction in the requirement of synthetic inputs and finally improving the crop yields.
- Care from Seed Treatment to Seed Production: Intervention of IRF Technology will provide wholesome care from seed treatment to seed production.
- Protect Health of All Family Members: Stoppage of toxic agro-chemicals will not only protect farmers' health by eliminating direct exposure but also benefit their entire family
- Protect Productivity of the Land Resource: Efficient resource recycling and reduction of toxic agro-chemicals will protect the soil from further deterioration.
- Reduce risk of crop failure due to Biotic & Abiotic stress: Intervention of IRF Technology will enhance plant immunity, which will reduce the risk of pest and disease invasion and increase plant resilience to the climate change impacts.

3.13 Clean Food Program: Benefit to Human Health & Environment

- Ensures Pesticide Free food Product: Clean Food Program will for the 1st time offer Pesticide Free Safe & Sustainable Food to the consumers, authenticated by laboratory analysis, certification and absolute traceability.
- Health benefit: Boosting Immunity: Only Healthy Plants can deliver healthy food rich in antioxidants, vitamins and minerals. Clean food program will ensures a sustainable agriculture practice with focus on Plant Health Management, which will help to eliminate the

use of synthetic inputs, leading to healthy food production.

- Clean Food Promotes Clean Environment : Clean Food Program will reduce the usage of synthetic chemicals specially toxic agro-chemicals, promote more use of recyclable farm resources, reduce GHG Emission and lower the risk of water pollution and thus promote Clean Environment.

4. CONCLUSION

Clean Food Movement is probably the first initiative toward Healthy Life & Farmers' Empowerment; through the development of pesticide- free clean food, establishment of a transparent system from farmer's field to the consumer plate, and sustaining the cost of production in order to ensure clean food affordability for all. This innovative Farmers- Participatory Program is based on a scientific- nature friendly-sustainable agricultural practice and a transparent/ analytically backed evaluation system with an objective to develop a Self-sustainable Consumer-Connect Agriculture Model; which can fuel livelihood upliftment of the farming community.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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