ICAR – Mahatma Gandhi Integrated Farming Research Institute

1. **Title of the project:** Assessment of natural farming in rice-wheat cropping system in north Bihar conditions
2. **Funding agency:** Institute (ICAR-MGIFRI)
3. **Total outlay:** ≈34 lakhs (excluding salary and wages)
4. **Duration: 5 years (wef July, 2022 -June 2027)**
5. **Single/ Multi-institutional:** Single
6. **Lead Centre if multi-institutional**
7. **Cooperating Centre(s):**
8. **Principal Investigator:** Dr. P.K. Bharti, Senior Scientist (Livestock Production & Management)
9. **Co-Investigators:** Dr. S. K. Singh, Principal Scientist (Agronomy), Dr. V.S. Meena, Senior Scientist (Soil Science)
10. **Rationale:** Indian agriculture has witnessed several changes from pre-independence to post independence period. After independence it was a big challenge to leaders, policy makers and agriculturist to feed the nation by availing sufficient food resources in terms of food grain, pulses, vegetables, oilseed and animal produces as our country was suffering from food scarcity. In order to fulfil the need of hunger driven people and enhancing the crop productivity, the green revolution was started in India with cultivation of high yielding dwarf variety of wheat. Day by day the green revolution changed the scenario of agriculture with high production of food grain, but on the other hand there were extensive applications of fertilizers on soil and mechanization of agriculture. The use of chemical fertilizer in farming practices has led to adverse effects in terms of soil degradation, losses of biodiversity, rising cost of cultivation etc. Rising applications of fertilizers and pesticides in crop fields not only raised the cost of production but also led to many indirect ill effects on soil health as well as public health. In order to reduce the chemical fertilizer in agriculture, the organic farming was started to curtail the use of chemical fertilizer and promote eco-friendly farm yard manure (FYM) in agricultural fields. Although organic farming is eco-friendly and produce good quality farm produces, it requires heavy amount of organic fertilizers/FYM to meet the nutritional demand in crop fields which is one of the costly affairs while its adoption and many times it is very difficult to follow the strict standards and principles of organic farming by the farmers. Hence, as an alternative to both organic as well as chemical/conventional farming, Natural Farming (NF) is being advocated which aims to eliminate all kinds of chemical fertilizers, pesticides usage, in the fields. Natural farming does not require chemical inputs or organic compost like vermi-culture. It promotes natural catalyst of biological activity in the soil and natural protection from diseases. It involves minimum intervention and it is assumed that it does not have any adverse effect on the surrounding environment as it also conforms to local biodiversity. There are many working models of natural farming all over the world. The Zero Budget Natural Farming (ZBNF) is one of those which is the most popular model in India. The ZBNF model of natural farming is the comprehensive, natural, and spiritual farming system was developed by Padma Shri Subhash Palekar. There are four wheels of NF which includes Bijamrita (seed treatment), Jeevamrit (use herbal fertilizer/pesticide), Mulching (soil, straw, live), and Waphasa (maintaining soil moisture). NF system requires native breed of cattle which is an integral part of farming families in rural areas. It is believed that one indigenous cow is sufficient to take up this method of farming on thirty acres of land (Palekar, 1995). The pest and disease in crops are controlled by the application of cow dung/urine-based herbal/organic pesticides like Agniastra, Brahmastra and Neemastra. These herbal pesticides are locally made using local cow dung, cow urine, green chillies, neem pulp, neem leaves which are easily available at farmers' farm and can be applied to control the pests like leaf roller, stream borer, fruit borer, pod borer, sucking pests and mealy bug etc.

The natural farming practice could be beneficial to farmers towards reducing cost of production and enhancing quality of farm produces and profitability in compared to conventional and organic farming, however scientific study with respect to local climate and cropping system need to be conducted in various geographical regions of the country. There is lack of scientific report on the practice of natural farming in north Bihar conditions where rice-wheat cropping system is very common. Keeping in view of the above, the present study has been undertaken to assess the natural farming in rice-wheat cropping system in north Bihar conditions.

11. **Research Gaps:** Although it is said that natural farming could be a substitute to conventional/chemical farming and eco-friendlier than organic farming, it is very difficult to adopt by farming communities unless scientific trials and validation being conducted at research plots/farmer's field. There are some reports which mention few preliminary trials on natural farming in states like Andhra Pradesh, Karnataka, Chhattisgarh, Jharkhand, Kerala, Madhya Pradesh, but the coverage on natural farming in India is too little despite abundant indigenous resources. Natural Farming is attaining wide scale in India among more and more farm families initially as a farmer-led social movement, and more recently with the adoption of a significant public policy in the state of Andhra Pradesh. Other state governments like Himachal Pradesh and Kerala are also initiating pilot programs in line with Andre's experience (Khadse and Rosette, 2019). In Bihar, particularly the northern part, rice is the main crop followed by wheat/maize. The north Bihar region comes under rainfed agriculture where extensive use of chemical fertilizer is being practiced which not only affected the soil health but also increased the dependency on external inputs in terms of seed, chemical, machines and labour cost thus ultimately reduce the profit from the farm. There is lack of scientific study on natural farming in compared with organic and existing conventional or chemical farming for rice-based cropping system in north Bihar. Moreover, the economics of natural farming in comparison to organic/semi-organic/chemical farming need to be evaluated from the views of farmer's acceptance and its feasibility in the region. Keeping in view the above scenarios, the present study has been proposed for assessment of natural farming in rice wheat cropping system in north Bihar conditions.

11. **Objectives:**

I. To assess effect of natural farming on productivity and profitability of rice-wheat cropping system in north Bihar
II. To standardize the frequency of application of Jeevamrit in natural farming for rice-wheat cropping system
III. To find out the effect of natural farming on soil fertility for rice-wheat cropping system

- **Activities/ Details of experiments**

Treatment details: A total of eight experimental plots of equal size (54m length x 8.85 m width with an area of 478 m2 approx.) were prepared for experimenting on natural farming in comparison with chemical or conventional farming, organic farming, and semi-conventional farming.

- A buffer zone of 1-meter width and raised soil bed of 0.5-meter height was made between each treatment to prevent seepage/intermixing of nutrients or inputs from one to other plots
- Each plot had 5 replications viz R1, R2, R3, R4, and R5 of equal size. Two cropping seasons were covered in the experiment viz. *kharif* and *rabi* in which rice and wheat were cultivated, respectively.
- The details of the treatments are T1: conventional or chemical farming, T2: Organic farming (based on use of FYM), T3- semi conventional farming (50% chemical and 50% FYM) and T4: natural farming (neither use of chemical nor use of FYM, only one-time application of Jeevamrita), T5: natural farming with 3 times Jeevamrita, T6: natural farming with 5 times Jeevamrita, T7: natural farming with 7 times Jeevamrita and T8: natural farming with 9 times Jeevamrita.

- The Bijamrita was used in only once in all-natural farming (T4 to T9). Each treatment had 5 replications viz R1, R2, R3, R4, and R5 of equal size.

- The Neemastra, Agniastra and Brahmastra were used as per the need to control the insect and pest infestation in field crops.

12. **Expected Output:**

    - It is expected that a suitable package of practices of natural farming for rice-wheat based cropping system will be developed in north Bihar region.
    - It will help to policy makers, researchers and farming communities to make a comprehensive plan towards adoption and intervention on choosing a better farming system at state and central level.

13. Expected Outcome

- The experimental trails from natural, organic and conventional will help the farmers to adopt the most suitable farming practices based on economic benefits and social acceptance as per the need in the region.
- It is expected that the products of natural farming (food-grains/other by products) will be safe and healthy for consumers and it may fetch higher market price to enhance the farmer's income.
- The practice of natural farming will reduce the dependency on costly fertilizers and pesticides by promoting desi preparations like Bijamrita, Jeevamtita, Neemastra etc. and also will promote the conservation of valuable indigenous animal resources (desi cow) towards strengthening the socio-economic conditions of the farmers.