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Proposal for how LCB Fertilizers Helps in Promotion of Organic Farming

1. Executive summary:

Organic farming is a holistic and sustainable approach to agriculture that eliminates synthetic inputs and relies on natural processes and on-farm biomass to enhance soil fertility and crop productivity. Aligned with this philosophy, we are developing single use, crop-specific organic biofertilizers made from natural materials like bagasse, cow dung, and agricultural residues.

These formulations are tailored for a wide range of crops including cereals, sugarcane, pulses, spices, fruits, and vegetables. By integrating eco-compatible technologies such as biotechnology, nanotechnology, and chemical engineering, we create advanced natural inputs that include beneficial microbes, nanoparticles, bioreactor-based fermentation, and superabsorbent polymers derived from agricultural waste.

These solutions significantly boost the availability of essential nutrients like nitrogen, phosphorus, and potash. Our organic inputs provide measurable benefits reducing farming costs by up to 21%, increasing yields by 15% to 35%, and lowering irrigation needs by around 33%, through the use of lignin-based superabsorbent polymers. Beyond these, they improve soil health by enriching microbial populations, balancing the carbon-to-nitrogen ratio, enhancing water retention, and promoting stronger root systems, thereby fostering long-term soil fertility and supporting the vision of a resilient, eco-friendly agricultural system.

2. Objectives:

- Reduce farming expenditure by 20%–25% by replacing costly chemical inputs with effective, natural, and sustainable alternatives.

- Improve crop yields by 15%–35%, while enhancing Soil microbial populations, The carbon-to-nitrogen (C/N) ratio, Humus content, ensuring long-term soil fertility.

- Minimize groundwater usage by at least 33% in the first crop cycle through the use of superabsorbent polymers made from agricultural waste (e.g., parali), which can absorb up to 268 times their weight in water.

- Generate rural employment by establishing each organic input production unit to support 5 skilled workers, 25+ unskilled workers and At least 35% women participation, promoting gender equity and community empowerment.

- Utilize low-nutrient agricultural residues as carriers for beneficial microbial consortia, enabling the development of crop-specific, eco-friendly biofertilizers through sustainable biotechnological processes.

3. Background and Motivation:

India's heavy reliance on chemical fertilizers has triggered a deepening agricultural crisis. Beyond contributing to air pollution, the overuse of synthetic inputs has severely damaged soil health by disrupting its pH balance, destroying beneficial microbial life, and significantly reducing its natural water-holding capacity. This degradation has forced farmers to depend on groundwater for nearly 85% of irrigation, intensifying the country's already critical water stress levels.

Soil microorganisms play a vital role in plant growth by breaking down organic matter and making nutrients bioavailable. However, chemical overload has devastated this microbial ecosystem, increasing dependency on external synthetic inputs. Alarmingly, more than 80% of applied chemical fertilizers remain unused, accumulating in the soil and entering the food chain contributing to rising rates of cancer and chronic illnesses in agricultural communities.

The economic burden is just as severe. The escalating costs of fertilizers, pesticides, and irrigation have pushed countless farmers into a cycle of debt and despair. According to the National Crime Records Bureau (NCRB), over 3,500 farmers in India die by suicide each year, many driven by financial distress caused by these unsustainable practices.

Organic farming offers a sustainable and life-saving alternative. By eliminating chemical inputs and embracing natural soil regeneration practices such as composting, microbial consortia, and moisture-conserving techniques organic farming restores soil vitality, reduces groundwater usage, cuts input costs, and boosts crop yields. More importantly, it enhances the wellbeing of farmers and communities. It is not just a path to sustainable agriculture it is a lifeline for the future of Indian farming.

4. Conventional solutions:

In the current agricultural scenario, farmers typically rely on three primary input categories chemical fertilizers, organic manures, and biofertilizers each of which presents limitations that hinder the shift toward truly sustainable organic farming practices.

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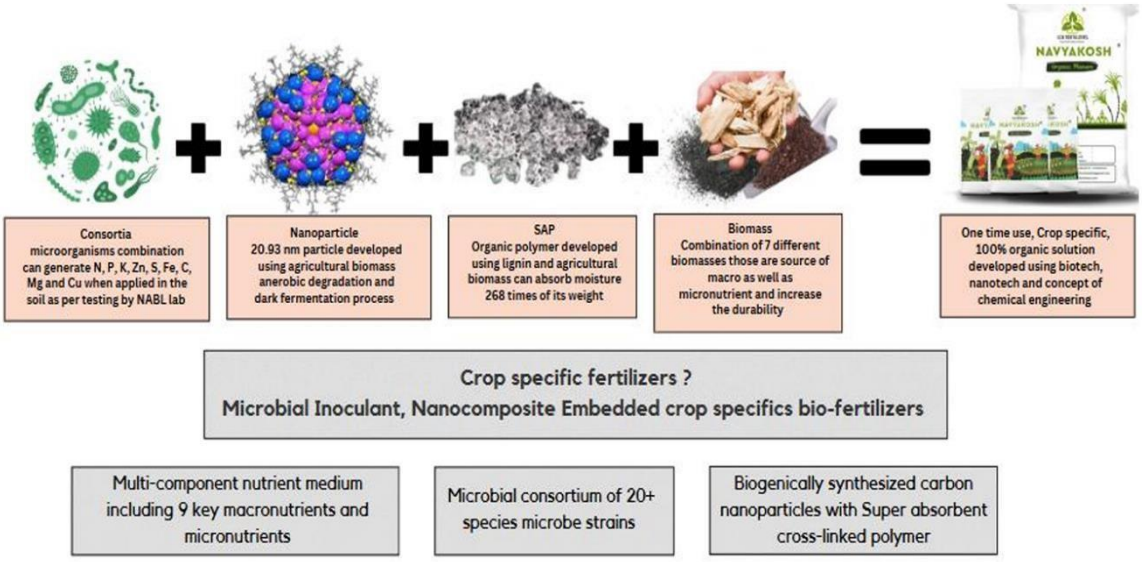
- Chemical Fertilizers (such as Urea, DAP, NPK, and Zinc Sulphate) are commonly used to supply essential nutrients. While they may offer short-term yield benefits, their prolonged use leads to significant soil degradation by disrupting pH levels, depleting organic matter and humus, and destroying beneficial microbial communities. This degradation results in declining soil fertility, increased irrigation dependency, and higher input costs, making farming economically unsustainable in the long run.

- Organic Manures, including vermicompost and farmyard manure, help enhance soil structure and humus content. However, to meet the full nutrient requirements of crops, large quantities are needed. This often drives farmers to supplement with chemical fertilizers, which undermines the fundamental principles of organic farming and limits its ecological and long-term benefits.

- Biofertilizers such as Mycorrhiza, Azotobacter, and Rhizobium provide microbial support for nutrient fixation but are often expensive. To sustain average yields, they are frequently used in combination with chemical and organic fertilizers. This hybrid approach complicates nutrient management, raises costs, and fails to achieve the desired sustainability outcomes.

  Organic farming provides a holistic solution by eliminating synthetic inputs and restoring soil and ecological balance through the use of biological soil enhancers, onfarm composting, beneficial microbial consortia, and natural moisture-retention techniques. It supports long-term soil health, reduces dependency on external inputs, and fosters a self-sustaining, cost-effective, and environmentally responsible agricultural system.



5. Novelty:

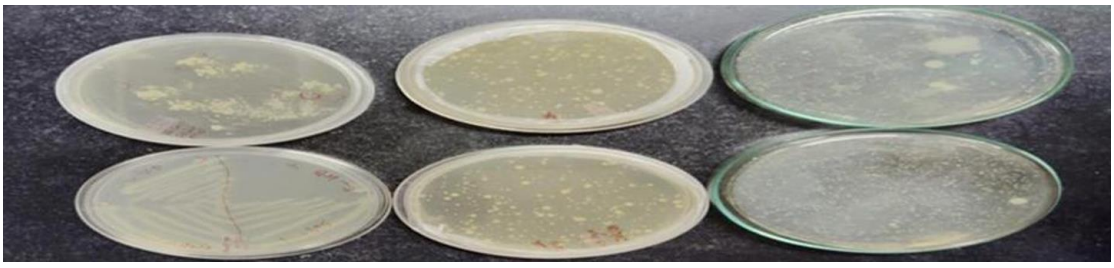
Our organic farming model is a pioneering integration of biotechnology, sustainable engineering, and eco-nanotechnology, offering a chemical-free, science-backed solution to modern agricultural challenges. By combining beneficial microbes, plant based biomass carriers, and biodegradable, moisture-retaining biopolymers, we develop 100% organic, crop-specific inputs that enrich soil health, improve nutrient availability, and reduce water usage without any reliance on synthetic chemicals. This unified approach supports environmental safety, cost efficiency, and long-term agricultural resilience.

Biotechnology Part:

At the core of our organic approach lies biotechnology focused on soil regeneration and plant nutrition through microbial synergy. We have engineered a robust consortium of 18 beneficial microbial strains bacteria and fungi sourced from natural ecosystems such as forest soils, organic farms, freshwater bodies, and compost piles. Each strain plays a distinct role in the solubilization and release of bioavailable nutrients like Nitrogen (N), Phosphorus (P), Potassium (K), Zinc (Zn), Iron (Fe), Sulphur (S), and Carbon (C) across the crop cycle.

These microbes are delivered through carrier media made entirely from nutrient-rich organic biomass including cow dung, jaggery residues, dairy byproducts, rice husk, and other crop wastes. These materials not only act as nutrient-rich substrates but also provide a protective, food-rich environment that keeps microbes viable in diverse soil conditions.

Field trials in Uttar Pradesh, Bihar, and Jharkhand have demonstrated a 42% rise in soil organic content, reaffirming the regenerative power of our bio-based formulations.



Nanotechnology Part:

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Our organic farming innovations include organically synthesized nanoparticles that enhance the performance of microbes by expanding their surface area and improving their heat tolerance up to 78°C. These nanoparticles significantly accelerate the breakdown of organic matter, improving soil aeration, texture, and nutrient cycling. By optimizing variables such as pH, temperature, fermentation time, and roasting techniques, we've ensured maximum microbial activity without any synthetic additives. This not only strengthens soil microbial biodiversity but also builds a resilient soil ecosystem crucial for sustainable organic farming.

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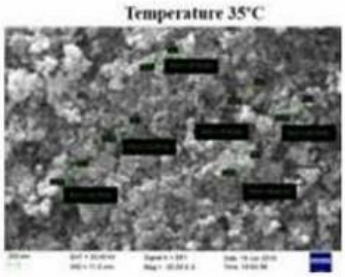
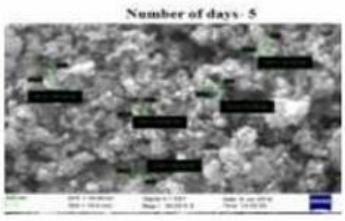
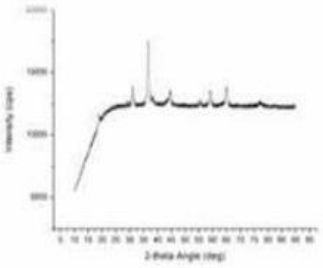
Emericella variecolor

Factor	Set-1	Set -2	Set -3
pH	6	7	8
^{0}C	35	40	45
days	5	8	10

Dark fermentation







Dark fermentation using agricultural biomass paddy s

Calcination at 600 ^{0}C and roasting at 60 ^{0}C

Chemical Engineering:

To efficiently scale up organic input production, we have developed low-cost, climate controlled bioreactors that enable anaerobic solid-state fermentation a clean, chemical free process. These bioreactors allow precise regulation of temperature, humidity, pH,

and agitation, ensuring the consistent production of crop-specific organic biofertilizers and bio-insecticides.

Alongside this, we have innovated a fully biodegradable superabsorbent polymer (organic hydrogel) derived from agricultural waste, capable of retaining water up to 268 times its own weight. This significantly reduces irrigation needs while also lowering plant stress markers such as electrical conductivity, proline, hydrogen peroxide, MDA, and POD activity, thereby improving crop health and resilience. When applied at the seed or soil level, this integrated, fully organic system effectively replaces synthetic inputs and streamlines the entire crop cycle.

Field trials have demonstrated yield increases of 15% to 40%, a reduction in irrigation needs by at least 33%, input cost savings of up to 45%, and a shortening of crop duration by 5–8%. This science-based, eco-friendly model offers a holistic, scalable, and profitable alternative to chemical-based agriculture, making organic farming more sustainable and accessible for Indian farmers.

6. LCB Fertilizers has tailored our innovations to develop the following:

Our organic farming toolkit integrates cutting-edge, eco-friendly innovations designed to enhance soil health, water efficiency, and microbial biodiversity all without the use of synthetic chemicals:

- Lignin-Based Organic Superabsorbent Polymer: Developed using plant-derived lignin and natural polymers, this biodegradable hydrogel exhibits exceptional water-holding capacity, retaining up to 268 times its weight in water. It helps maintain soil moisture for up to 35 days, reducing irrigation frequency and enhancing the drought resilience of crops an essential support in rain-dependent and arid regions.

- Natural Enzyme Consortium: Sourced through organic fermentation techniques, our enzyme blend remains active across a wide pH range. These enzymes accelerate the breakdown of crop residues and organic biomass, leading to increased humus formation, improved microbial diversity, and higher soil organic carbon content all of which are foundational to sustainable soil fertility in organic systems.

- Green-Synthesized Nanoparticles: Extracted through eco-friendly synthesis from medicinal and native plants, these nanoparticles enhance the thermotolerance of beneficial soil microbes, allowing them to remain active even at soil temperatures as high as 78°C. Their role in faster organic matter decomposition and improved nutrient release ensures enhanced plant health without leaving behind any chemical residues.

- Low-Cost Anaerobic Bioreactor: Tailored for on-farm application, this bioreactor creates controlled anaerobic conditions to cultivate native microbial communities vital

for organic farming. It efficiently processes cow dung, crop residues, and bio-enzymes into high-quality, climate-resilient organic biofertilizers, eliminating the need for synthetic inputs while promoting localized, circular resource use.

Together, these innovations empower organic farmers with sustainable tools that regenerate soil ecosystems, improve crop performance, and strengthen climate resilience paving the way for a truly chemical-free, regenerative agriculture model.

7. Commercialization model:

To drive the large-scale adoption of organic farming across India, we have designed a four-step commercialization model anchored in community participation, environmental sustainability, and rural upliftment. The first step involves establishing trust and scientific validation by distributing free samples of our organic inputs for comparative field trials across multiple districts. These trials, conducted in partnership with Krishi Vigyan Kendras (KVKs), agricultural universities, and progressive farmers, aim to demonstrate the ability of our organic solutions to enhance soil fertility, crop yields, and pest resistance without relying on chemical inputs. Upon observing positive outcomes, the second step centres on building grassroots capacity through farmer training sessions, Kisan Chaupals, and village-level workshops, with a special focus on empowering women and self-help groups. These initiatives not only promote sustainable cultivation techniques but also foster local employment.

In the third phase, we focus on last-mile delivery by establishing a decentralized rural distribution system. This includes the creation of village-level organic resource centres or bio-input outlets managed by local entrepreneurs, FPOs, and rural youth, ensuring easy accessibility of organic products to farmers. The final step emphasizes localized production through small-scale, community-run manufacturing units set up in collaboration with agro-industries and sugar mills. These units will utilize agricultural by-products such as bagasse, cow dung, and crop residues for the eco-friendly, chemical-free production of organic biofertilizers and bio-insecticides. Each unit will generate employment for over 200 skilled and unskilled workers, with a strong focus on women's participation and leadership. Altogether, this inclusive model supports the transition to organic agriculture while enabling self-reliant rural economies, ecological restoration, and sustainable community development.

8. Benefits:

i) Environmental benefits:

- By incorporating plant-based Super Absorbent Polymers (SAPs), beneficial native soil microbes, and humus-enhancing agents, we substantially boost the soil's water retention capacity. These eco-friendly hydrogels can hold up to 268

times their weight in water, reducing reliance on groundwater and cutting irrigation needs by up to 33%, thereby promoting sustainable water management in organic farming systems.

- Our microbial formulations, sourced from indigenous and beneficial soil organisms, increase organic matter content by 32% to 74% within a single cropping cycle. This improvement strengthens soil structure, enhances aeration, and supports long-term fertility key pillars of natural soil regeneration in organic agriculture.

- The diverse consortium of microorganisms in our organic biofertilizers actively decomposes residual agrochemicals and synthetic toxins found in degraded soils. This natural bioremediation process helps restore soil purity and health, fully aligning with the zero-chemical ethos of organic farming.

- All inputs are made exclusively from natural, farm-based, and biodegradable materials, ensuring no ecological damage or harmful residue accumulation. They function in harmony with the environment, enriching soil vitality while preserving biodiversity and preventing water pollution.

ii) Social benefits:

- Through our organic farming initiatives, we aim to create over 500 direct and 2,000 indirect employment opportunities across rural India. By leveraging locally available resources and promoting on-farm production of organic inputs, we are building sustainable livelihoods for both skilled and unskilled workers. A key focus is empowering women and youth through hands-on training in ecofriendly, organic practices.

- Our current team of 28 members includes 9 women and a female co-founder, underscoring our strong commitment to gender inclusivity. We are expanding women's participation at every level supporting their leadership in organic input production, on-field training programs, and decentralized distribution systems.

- We collaborate with Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), NGOs, and grassroots bodies to strengthen a community-driven organic farming ecosystem. These partnerships not only support the dissemination of organic techniques but also generate additional income for local communities through affordable input solutions and improved farm profitability.

- Ultimately, this model promotes economic self-reliance by reducing farmers' dependency on costly chemical inputs and enabling a shift toward sustainable, organic alternatives rooted in local knowledge and biodiversity.

iii) Economic Advantages:

- Our organic inputs have consistently led to crop yield improvements of 15% to 35% across various agroclimatic regions, proving that chemical-free, organic cultivation can be both productive and sustainable.

- Farmers who have adopted our organic solutions report input cost savings ranging from 5% to 48%, depending on the crop and geographic conditions. These savings are achieved by replacing expensive synthetic agrochemicals with affordable, farm-derived organic alternatives.

- By incorporating organic hydrogels and enhancing soil organic matter, irrigation needs are reduced by up to 33%, contributing to efficient water management especially crucial for drought-prone areas.

- Our formulations simplify input application, minimizing the need for repetitive treatments and reducing dependency on manual labour. This empowers farmers to cultivate larger plots with fewer resources.

- Built on a scalable, community-centric model, our organic farming initiative is designed to reach over 2.5 lakh farmers across India. We aim to equip them with low-cost, environmentally responsible solutions that promote a resilient and self-sustaining organic farming ecosystem.

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