



Development and validation of zero budget natural farming protocol in food-fodder production system of Bundelkhand region

¹Vikas Tiwari and ²Sangya Payasi

Introduction

India is self reliant in food production at present, owing to scientific and technological innovation led green and various other revolutions in agriculture and animal husbandry. However, this high external input led modern agriculture also created several challenges such as depletion of natural resources (mainly soil, air, and water), climate change, low factor productivity, enhanced input cost, low energy efficacy, agri-produce quality concerns, dismantling of traditional farming and cropping systems, change and replacement of traditional and cultural package of practices and loss of viability of agro-eco-system.

The essence of farming revolutions was localized to some special regions which created regional disparity in agricultural growth, economic development and thus social wellbeing. The bundelkhand region of Central India has been such a victim.

Bundelkhand region has been very rich in culture and tradition particularly in agriculture

and livestock area. It has been a home to various traditional crops such as millets, pulses, oilseeds, beetle leaf, sunhemp, and structures such as indigenous soil and water conservation structures, food grain storage structures and various indigenous technical knowledge (ITKs) on agriculture, livestock, and social system. However, as a result of globalization and modernization of society including agriculture has endangered above mentioned cultural and traditional identity of Bundelkhand. The area replacement of millets and pulses with high input (nutrient and water) responsive cereal crops such as paddy and maize in kharif.

The government's commitment towards promoting sustainable ways of farming is reflecting clearly from the ongoing programs such as Paramparagat Krishi Vikas Yojana (PKVY), Organic Value Chain Development for North East Region and National Project on Organic Farming under which government enhanced budgetary allocation from 461.3 crore (2019-20) to 687.5

¹Vikas Tiwari, and ²Sangya Payasi

¹Research Scholar (Agronomy), Department of Natural Resource Management, M.G.C.G.V., Chitrakoot Satna, M.P.

²M.Sc (Soil Science), Department of Natural Resource Management, M.G.C.G.V., Chitakoot Satna, M.P.

crores (2020-21) (DownToEarth, 2020). Govt. has allocated 120 crores to Department of Agricultural Research and Education (DARE) to conduct experiments at multiple locations and gather findings to establish the viability of zero budget natural farming (ZBNF) (The Print, 2019).

ZBNF is an agro-ecological farming approach, led forward by Padma Sri, *Shri Subhas Palekar* that promotes growing crops in harmony with nature. The concept of natural farming aims at farming ‘with nature’ and ‘without chemicals’. It is about growing crops through a number of agro-ecological principles, including integrated approach, crop diversification, intercropping, nutrient recycling, biological symbiosis, mulching, optimized tillage etc. (Palekar, 2006). Term ‘Zero budget’ does not literally mean that costs are ‘zero’, but rather implies that the need for external financing is zero, and that any costs incurred can be offset by a diversified source of income. ZBNF enshrines the concepts of ‘back to basic’ and ‘farm autonomy and self reliance’ (Khadse, 2019).

ZBNF is based on the four pillars (Palekar, 2014) viz. *Bijamrita* (a seed treatment), *Jivamrita* (a soil inoculant), *Acchadana* (soil mulching) and *whapahasa* (soil aeration).

In this system, soil is supplemented with the inoculums like *Bijamrita* and

Jeevamrit to accelerate the propagation of soil existing micro flora. Fermented organics like *Bijamrita* contains not only general microflora, but also certain beneficial free living nitrogen fixers, phosphorus solubilizers and bacteria producing plant growth promoting substances which helps in the improvement of seed germination, seedling length and seed vigour index of crops (Sreenivasa et al. 2009).

Mulching in ZBNF takes various forms. “Live mulching” is promoted with cover crops of a mix of monocotyledons (like millets) and leguminous dicotyledons (like beans). The monocots provide nutrients like potash or phosphate, while the dicots help in nitrogen-fixing (Palekar 2006). Straw mulching is also promoted, using dry crop residue.

Whaaphasa means water vapor. It is claimed that roots absorb water vapor and not water (Palekar, 2006). It promotes a microclimatic condition around the roots, where there is a mix of air and water molecules and rejects overwatering thus, prescribing for watering only when the sun is high at noon for optimum *whaaphasa* formation. In this way, 90% of water use can be reduced through ZBNF practices making it ideal for rain-fed area like Bundelkhand (Palekar 2006).

A number of natural fungicides and pesticides formulations referred as *Agniastra*,

Brahmastra, Neemastra are prescribed to made from locally sourced ingredients like neem leaves, chilies, garlic, tobacco, sour buttermilk (Palekar, 2006). Enhancing functional diversity of farming is a critical principle of ZBNF; for which, a number of crop combinations, with a view of increasing functional bio-diversity are proposed.

Review of work

The concept of ZBNF is not a new one. It's an age old traditional and cultural system of farming whose essence has been diluted with the inception of high external input based modern agriculture.

The effort for the revival of traditional ZBNF approach was started in the 1990's. Several states throughout India have witnessed widespread adoption of ZBNF in Karnataka, Kerala, Tamil Nadu, Maharashtra, Uttarakhnad, Andhra Pradesh and Himachal Pradesh (PIB, 2019). Despite of accelerated movement for ZBNF at grassroots level, it barely received much attention from policymakers, scientists or even NGOs except from last few years. Yet today, one south Indian state, Andhra Pradesh, is attempting to scale up ZBNF across the entire state though comprehensive public policies. Inspired by Andhra Pradesh, other state governments are also showing keen interest and have made initial budgetary allocations.

Over the years of research, Palekar revealed that ZBNF is self-nourishing and symbiotic where, only, the dung from local, Indian cows is effective in the re-enrichment of the barren soil; urine, jaggery and dicot flour can be used as additives; the lesser milk the cow gives, the more beneficial its dung is towards reviving the soil (Palekar, 2014 and Yogananda, 2008).

Gore et al. (2011) worked on assessing the efficacy of Beejamruth, Jeevamruth, Panchagavya in vegetable crops and found that application of these liquid manures could results into higher yield due to growth promoting action as compared to recommended dose of chemical fertilizers. In a study of comparative economic analysis of ZBNF based groundnut under dry zone of Karnataka, it is reported that ZBNF saves cost of cultivation by 22.5%, enhanced benefit-cost ratio while, non-significant reduction in yield over recommended conventional practice. Similarly, Gupta et al. (2020) reported reduced cost of cultivation under ZBNF based rice and maize crop. Regarding farm design under ZBNF, Palekar's advocated the five-layer model; a type of agro-forestry model which integrates trees with various levels of plant canopies, each layer at an optimum level to harvest the sunlight it needs (Palekar, 2006).

Despite of ample scientific evidence of ZBNFs ecological benefits such as

improvement in functionality of farm biodiversity, enhancing soil microbial activity, on-farm soil and water conservation, quality and acceptable food-fodder-fibre production etc., ZBNF is not getting momentum at country level as well as in Bundelkhand.

Relevance to Heritage Science

Traditionally, the Indian agriculture has been based on the principles of natural farming where, a sustainable production system was maintained along with balance in the agro-eco-system. The basics of ZBNF (farming with nature, harnessing the natural resources sustainably, managing nutrients, pests and diseases naturally with organics, less dependency in external inputs and the Gandhian philosophy of farm autonomy) are also inspired with traditional and heritage agriculture science of India.

Its four pillars viz. Bijamrita, Jivamrita, Acchadana and Whapahasa are also described in the 1940's book of organic and natural farming 'An Agricultural Testament' by Albert Howard. The integration of food and fodder crops (livestock) and cultivation under the principles of cropping system, organic manuring, natural pest management, soil conservation by mulching is also described in Atharvaveda.

Bundelkhand has been a home to different species of indigenous animals. Kenkatha (Cow), Bhadawari

(Buffaloes), Jamunapari and Barbari (Goats) and Muzaffarnagari and Jalauni (Sheep) are some examples of native breeds of Bundelkhand which are unsecured at present due to the non-integrated approach of animals with crops and enhanced feeding cost owing to less availability of green fodder. Hence, uplifting fodder production may be a relevant task towards conservation of native breeds of Bundelkhand which is the heritage of the region.

Hence, in order to revive agro-eco-system viability, to integrate the food and fodder crops (livestock) as a system and to conserve indigenous varieties/breeds of BN Hybrid, wheat, groundnut and animals, the experimentation, validation and promotion of ZBNF based food-fodder system may be an important S&T move in Bundelkhand.

Opportunities and threats of ZNBF

- Bundelkhand region is characterized by low productive agriculture and livestock, huge deficit of green fodder, extreme weather events (drought, flood, and heat waves), low fertile soils, resource poor farmers, less availability of market for organic produce etc. Under such scenario, ZBNF offers ample opportunity to harness.
- Besides, it offers the opportunity to for revival of traditional agricultural production system as well as traditional

crop varieties/animal breeds. It is a 'road to basics' with nature for a sustainable and healthy future.

- Increasing cost of cultivation is the major factor for low profitability of agriculture. ZBNF offers opportunity to reduce exchequer on fertilizer subsidy, investment on agro-chemicals and hence may reduce cost of cultivation.
- Another major opportunity from the project is its scientific investigation into the basics and mechanism of ZBNF which will outcome some authentic and valid findings and reports which would be used by the Government, policy makers and researchers to solve the puzzle 'ZBNF: Reality or just a myth'.
- Apart from opportunities, food-fodder ZBNF project is bundled with some threats. The initial slight reduction in crop yield performance (as evident from various organic production trials), which may affect its popularity. However, it is assumed that this reduction is temporary and may overcome in long period adoption of ZBNF.

Component in the ZNBF

1. ZBNF is based on the concept of natural science completely. It's all facets viz. Bijamrita (a seed treatment), Jivamrita (a soil inoculant), Acchadana

(soil mulching) and whapahasa (soil aeration) are having some scientific rational and mechanism.

2. *Beejamrit* and *Jeevamrit* accelerate the soil micro-flora which improves soil health and its functional potential.
3. Mulching is a scientifically justifies way of soil, nutrient and water conservation.
4. Whaaphasa based on the theory of accelerated root rhizosphere which efficiently utilizes water and nutrients.
5. The concept of integrating food with fodder is following the principle of integrated farming system, a scientific approach to enhance farmer's income and farm sustainability.
6. Enhancing fodder security through inclusion of BN Hybrid in system is a scientific approach of animal productivity enhancement and breed improvement. BN Hybrid helps in reducing the cost of animal production by assuring round the year availability of quality fodder.
7. Overall, the project is designed in such a way as to touch all the possible horizons of S&T to outcome scientific and acceptable conclusion on ZBNF.
8. The outcomes of the project will be highly useful for the science think tanks such as researchers and research

policy makers (ICAR, DST, SERB, DBT etc.) to decide future planning and strategy for promoting ZBNF and other sustainable and traditional agriculture system.

Detailed Plan of ZBNF

- Development and validation of zero budget natural farming protocol in food-fodder production system of Bundelkhand region' is based on the theme of sustainable agriculture which requires a sufficient large period (more than 5 years) to establish sustainability in real sense.
- some long term sustainability parameters such as carbon sequestration, climate resilience, soil pollution are not added in the study.

Therefore, further continuation of such farming system to long term (more than 5 years) may be a way forward. Additionally, different cropping systems perform differently under same protocol of production. Hence, investigation the ZBNF on other cropping systems is also a way forward to find out broadly accepted outputs and impact.

Status of ZBNF (National & International)

- The Government's commitment towards promoting sustainable ways of farming is reflecting clearly from the ongoing programs such as

Paramparagat Krishi Vikas Yojana (PKVY), Organic Value Chain Development for North East Region and National Project on Organic Farming under which government enhanced budgetary allocation from 461.3 crore (2019-20) to 687.5 crores (2020-21) for conducting nationwide research and experimentation (DownToEarth, 2020).

- Govt. has allocated 120 crores to Department of Agricultural Research and Education (DARE) to conduct experiments at multiple locations and gather findings to establish the viability of zero budget natural farming (ZBNF) (The Print, 2019).

- Farmer participatory validation of NF practices in farmers' field under SCSP/STC sub plans at Bajaura (HP), Coimbatore (TN), Ranchi (Jharkhand), Umiam (Meghalaya), Gangtok (Sikkim), Udaipur (RJ), Thiruvananthapuram (Kerala) under All India Network Programme on Organic Farming (AI-NPOF) is being operated.

- However, food-fodder system is not the part of any such countrywide experimentation.

Conclusion

The unique opportunity to eradicate poverty and hunger in our generation and make agriculture and food systems more sustainable should not be missed. The primary objective of agriculture -- which cannot be compromised -- is to produce enough food to sustainably feed 9 or 10 billion people by 2050. This largely needs to be accomplished by crop and animal productivity increases, reducing food losses and waste, and changing diets, always keeping in mind that the Earth's natural resource base is finite.

Meeting future food demand will require shifts in behavior as well as shifts towards more sophisticated technologies, information and knowledge management systems for farming systems and whole value chains, but also policy-- making, and market and incentive systems for investment in ecosystem services.

We need to be realistic about the future of smallholder farming in developing countries. For many small farming households exiting the agricultural sector may be the best strategy to overcome current poverty traps caused by resource constraints that also restrict the adoption of better technologies.