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Padmanath Sinha
PG Student, School of Agriculture,
Uttaranchal University, Dehradun,
Uttarakhand, India

Dr. Jayanti Ballabh
Assistant Professor, School of
Agriculture, Uttaranchal
University, Dehradun,
Uttarakhand, India

Dr. Sharad Pandey
Professor, School of Agriculture,
Uttaranchal University, Dehradun,
Uttarakhand, India

Conventional farming vis a vis natural farming in the context of lentil cultivation: A review

Padmanath Sinha, Jayanti Ballabh and Sharad Pandey

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Abstract

The agricultural landscape of the world is experiencing a tremendous shift guided by growing demand to understand the environmental and health effects of the traditional farming practices that are chemical intensive. On the contrary, natural forms of farming, which focus on the environmental harmony and the removal of synthetic materials, are becoming a popular alternative to sustainability. This review article focusses on available literature based on the impact of natural farming on lentil (*Lens culinaris*) growth and yield in comparison to the conventional methods. Based on a comprehensive selection of peer-reviewed literature, including field trials, long-term research, and systematic review across agro-climatic regions, the purpose of the given review is to put the frequent contradictory results regarding the issue together to arrive at a verified explanation. The study envisages that although the final yield may be compromised over initial few years, natural methods of farming can result to a level of high stability and in most situations, even increased yields of lentils. This is mainly due to the long-term gain in soil health, superiority of micro-organisms biodiversity, retention of water, and less dependence on external inputs as it becomes a total contributor to the resilience and yield of the lentil crop. Other ecological and economic benefits of chemical-free agriculture, including lower costs of production, limited soil and watershed contamination, and protection of natural pollinators and useful insects, are also added in the review. To sum up, natural farming is a prospective and successful way of producing lentil on a sustainable basis.

Keywords: Lentil, sustainable, agroecology, soil-health, natural-farming, yield

Introduction

Legumes are the main source of vegetative protein and have been identified as essential for both food security and addressing dietary needs. Pulses can work as a "mini nitrogen factory" in addition to being an excellent source for proteins and vital amino acids, which can help preserve the ecological equilibrium and lessen the need for artificial fertilizers. Legumes are now acknowledged for their significant role in agricultural sustainability and crop diversification. Legumes are becoming more and more significant in the face of immediate concerns like population growth, climate change, and the deterioration of agricultural land. The output of three edible legumes, faba beans, lentils, and chickpeas has declined in the last ten years. Agricultural legume cultivation practices in developing nations have mostly remained unchanged or have decreased, despite the availability of several high-yield cultivars and sophisticated production techniques that should produce greater and more consistent yields. Food legumes are just as vital in developing nations like India as cereal grains as well as oilseeds (Mukherjee *et al.*, 2023) [25]. The cultivation of crops without the application of agrochemicals as well as other ex-situ inputs is the focus of natural farming. By reducing reliance on outside market-based inputs, it fosters positive relationships with the natural world and regional ecosystems. This new paradigm has led to the emergence of the Natural Farming Movement throughout the state, which aims to provide long-term economic, ecological, and social advantages. Farmers that practice natural farming increase their income by using less expensive inputs. Farmers are recommended to utilize cow dung, urine, local herbs, earthworms, and decoctions created from other locally accessible resources for crop protection. In addition to improving food security, it encourages farmers to maintain traditional crop types since they are resilient and contribute to the preservation of our traditional culinary systems (Vashishat, R. K., 2025) [36].

Corresponding Author:
Padmanath Sinha
PG Student, School of Agriculture,
Uttaranchal University, Dehradun,
Uttarakhand, India

Conventional Agriculture

The term "conventional agriculture" refers to a counterpoise, comparative, or "control treatment" that may be used to evaluate, contrast, and compare various farming methods. Here, conservation agriculture vs conventional agriculture, no-till agriculture vs conventional agriculture, natural farming (or farming, farms, or practices) vs conventional agriculture (or farming, farms, or practices) are frequently compared. In the discursive formulation of the argument for alternative agricultural practices, the word "conventional agriculture" is utilized (i.e., alternative to conventional agriculture). These include being inherently unsustainable, harmful to the environment, creating greenhouse gases, highly mechanized, large-scale, controlled by corporate interests, detrimental to rural populations, unaccountable, and so on (Sumberg and Giller, 2022) ^[32].

Demerits of Conventional Farming Practices in Lentil Cultivation

One of the biggest difficulties facing contemporary agriculture in the upcoming decades will be increasing crop output through sustainable farming techniques while keeping soil health and environmental quality. This mirrors the worldwide population, which is forecast to be increase to 9.1 billion till 2050 (Singh *et al.*, 2023) ^[31]. The primary challenges facing the food and agricultural sectors in the twenty-first century include the impact of climate change on conventional farming practices, as well as the need to use eco-friendly practices to produce more and higher-quality grains. Because of its high nutritional content, polyphenols, as well as other bioactive substances, the seeds of the lentil (*Lens culinaris Medik.*) are currently designated as functional food, making it an essential legume for human as well as animal dietary needs. It is well recognized that lentil seeds provide the body with both essential and non-essential amino acids that are necessary for a balanced diet, making them a plentiful source for protein storage and a competitive substitute for animal protein (Tziouvalekas *et al.*, 2022) ^[35]. It is commonly recognized that while applying inorganic fertilizers might result in increased yields in short periods of time but they may also negatively affect the physio-chemical and biological properties of soil which can impact soil health and productivity over time. In addition to increasing the amount of soil organic matter (SOM) and cation exchange capacity (CEC), organic manures also improve the biological, chemical, and physical characteristics of soil (Singh *et al.*, 2023) ^[31].

Importance of Natural Farming

Some of the earliest crops of legumes to be grown was lentil (*Lens culinaris Medic.*). It is a desired component of a regular diet because of its beneficial chemical makeup and health-promoting qualities. In addition to having a high content of phytoestrogens, folic acid, group B vitamins, and minerals, lentil seeds also include between 24 and 32% of essential protein. Particularly on natural farms, lentil may play a part in crop rotation, preserving soil fertility and the biological balance of agroecosystems. It's also important to emphasize the unique capacity of leguminous crops to coexist alongside rhizobia that fix free nitrogen from the atmosphere. Despite lentil's numerous positive traits, natural farms only grow a small amount of this crop which is probably because it is not very competitive with weeds and is quite susceptible to lodging (Kraska *et al.*, 2019) ^[19]. Studies on the cultivation of lentil have demonstrated that

problems such as poor growth, nodule senescence, and low seed setting in pulses may be resolved by foliar application of nutrients, especially NPK (nitrogen, phosphorous, and potassium), at particular growth phases. Furthermore, it has been shown that organic materials like cow urine, Panchagvaya (a mixture of cow dung, urine, milk, curd, and ghee), and Jeevamrutha (a bioenhancer) support immunity, plant growth, and soil fertility. By supporting a number of physiological processes including glucose metabolism, flower retention, and seed development, micronutrients like boron also have a significant impact on lentil productivity and quality. In the same way, Vermiwash, an environmentally friendly plant stimulant made from earthworm products, promotes root development, plant growth, and overall crop yield (Aswal *et al.*, 2025) ^[6].

Components of Natural Farming

Jeevamrit is a natural fertilizer made by fermenting a combination of cow urine and cow dung. It increases the activity of beneficial bacteria and earthworms in the soil and supplies nutrients to the plants. The bacteria found in cow dung and urine use the nutrients from the flour dust to grow throughout the fermentation process. Because the beneficial microorganisms in the same soil might be replicated and provide efficient results, a handful of soil is gathered precisely from the location where it is to be administered. Farmers benefit from it because it reduces the quantity of dangerous bacteria and fungi in the soil. Beejamrit precludes the chances of fungi infection in young developing roots and also prevents all the sapling diseases like damping off and other diseases occurring after the rainy season. Moreover, Beejamrit enhances the quality of the soil by increasing its microorganism activities and thereby plant's ability to absorb micro-nutrients from the soil (Prasada, 2016) ^[27]. Strong inorganic fertilization techniques significantly harm soil health and raise crop input costs. In order to provide alternative fertilization methods for soil nutritional enhancement and plant development, organic natural fertilizers like Jeevamrit, which are being created using inexpensive, rural nitrogen and carbon sources, are now required. Until now, researches have ignored underlying processes in interactions between key organic ingredients of Jeevamrit (jaggery and gram flour). In light of these weakpoints, the article discusses how to optimize these precursors in order to confirm their essential function in the nutritional properties of the Jeevamrit natural fertilizer. (Bhattacharjee and Uppaluri, 2023) ^[8].

Comparative impact on Lentil yield

Agriculture is a key sector in the Indian economy, providing work to a significant proportion of the population. The country's fast population increase makes it more important than ever to ensure food security, which calls for more precise agricultural production forecast techniques. This study utilizes growth parameters as indicators to assess how well different machine learning models predict lentil crop production. Conventional methods, such as multivariate linear regression, have demonstrated accuracy limits. On the other hand, the non-linear relationships between input variables (such as soil characteristics, environmental factors, along with farming practices) as well as yield outcomes, machine learning techniques like support vector machines, decision trees, along with artificial neural networks provide better alternatives (Chugh *et al.*, 2024) ^[12].

Year	Treatment	Plant Height (cm)	Grain Yield (q ha ⁻¹)	References
2025	Conventional farming (RDF/NPK)	21.5	7.5	(Aswal <i>et al.</i> , 2025) ^[6]
	Natural Farming (Beejamrit + Jeevamrit)	28.3	12.5	
2024	Conventional Nutrient Management in Lentil	28.3	30.4	(Verma <i>et al.</i> , 2024) ^[37]
	Natural Farming using Beejamrit + Jeevamrit	43.2	33.2	
2023	Conventional Farming	39.4	13.5	(Duddigan <i>et al.</i> , 2023) ^[16]
	Natural Farming (Beejamrit + Jeevamrit based ZBNF)	47.1	18.2	

Soil health and environmental impact

In addition to being a vital protein source, energy, important amino acids, dietary fiber, minerals, and vitamins, pulses also contribute significantly to global security of nutrition. Between 1961 and 2020 (60 years), the world's pulse area, production, as well as average productivity all rose. Pulses are often cultivated in rainfed, extremely unstable, and complicated production conditions with significant soil and environmental component variability, high output fluctuation from year to year, and volatility in soil moisture. Due to the severe conditions in which pulses are grown and the ongoing ignorance of farmers and governments regarding policy planning, there hasn't been much of a satisfying increase in pulses' production during the past 60 years. Because of this, the amount of food supplied globally through pulses remained insignificant, making up just around 1.0% of the overall supply of food including 1.2 percent of the vegetarian and vegan food system. In this case, the issue of protein-rich diet is still being discussed on a worldwide scale in an effort to eradicate malnutrition. In addition to being an important part of agricultural biological variety, pulses are crucial for combating climate change and providing vegetarians with an energy-dense diet (Kumar *et al.*, 2023) ^[20].



Fig 1: Lentil cultivation. Source: (*Lentil Soil Requirements, Soil Preparation and Planting* | Wikifarmer, n.d.)

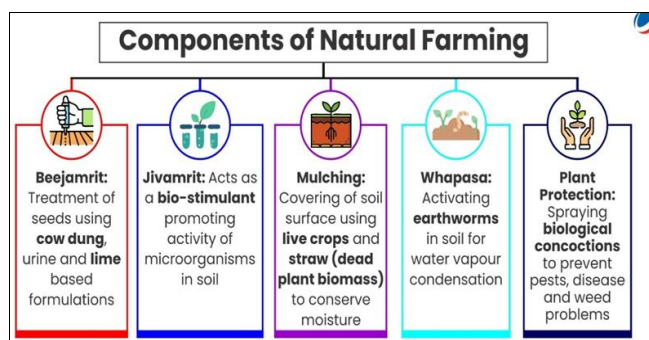


Fig 2: Components of Natural Farming. Source: (*Natural Farming* | Current Affairs | Vision IAS, n.d.)

Conclusion

The move towards traditional agriculture to natural farming by use of chemicals is an opportunity to the sustainability and resilience production systems of lentils. The articles analyzed in

this paper suggest that several natural farming methods, including Beejamrit application, Jeevamrit, mulching, and incorporation of residue, and biological soil ameliorants, have the potential of enhancing soil health, microbial activity, and nutrient recycling, as well as enhancing and maintaining or even better long-term lentil production. Although yield reaction can change in relation to the aforementioned factors: soil, climate and management, the ecological outcomes in the long-run such as the lower expenditure in inputs, extended soil organic matters and ultimate enhancement of the environment illustrate the promise of natural farming as an option to chemical intensive farming. The larger adoption, however, remains subject to countering some challenges affecting its adoption, which include limited awareness, transitional yield gaps and scientific validation requirement in various agro ecologies. In general, natural farming is a good direction to sustainable lentil production with the effective balance of productivity and ecology.

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