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- **Member: PWD committee of Admission (2025-26):** For Document verification.
- **Co-convener**, Equal Opportunity Cell, Kalindi College.
- **Verification Committee of Physics, Computer Science and Mathematics Department**

- Participated as an Invited Speaker and delivered a talk on ***"Role of Geospatial Technologies (GIS, Remote Sensing, GPS) in Wildlife Conservation and Biodiversity Management"*** in the National Conference on Viksit Bharat @ 2047 organized by S.S. Jain Subodh P.G. College, Jaipur, held on March 10–12, 2025.
- Presented a paper titled as ***"Synergistic Effects of Hygiene & Nutrition in Achieving Global Health Goals"***, organized by Seth Nand Kishor Patwari Government College, Neem Ka Thana (Rajasthan), India, held on 3–4 October 2025.
- Participated as a Resource Person in the Two-Day Multidisciplinary National Seminar on ***"The Role of Youth in India's Development in the Present Context: Diverse Dimensions"*** organized by organized by the Internal Quality Assurance Cell (IQAC), Swami Vivekanand Government College, Khetri (Jhunjhunu), held on 3–4 November 2025.

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REVIEW ARTICLE

Organic farming: A strategy for a sustainable and secure food system

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Abstract

The growing human population presents a global challenge in providing adequate food, shelter and a healthy lifestyle. Sustainable food production and environmental stewardship are essential for addressing food security and environmental preservation. Organic farming is gaining popularity due to its perceived safety, health and ecological benefits. However, there are differing viewpoints on its role in sustainability. Despite advances in agricultural productivity and the use of GMOs, hunger persists in the poorest countries. This review aims to answer whether organic farming is the future of sustainable agriculture to address the world's growing food needs. The Green Revolution has led to increased agricultural output and income, but it has also led to lower-quality food and environmental degradation due to chemical use. Health concerns, such as hormone imbalances and cancers, have been raised due to these practices. Organic farming, which avoids artificial inputs and uses biological control methods, has gained momentum in developed nations. It promotes ecological restoration, plant, animal and soil health and improves biodiversity. Sustainable agriculture should support boththe economy and the environment.

Keywords: biological control methods; environmental stewardship; food security; global challenge; organic farming; sustainable agriculture

Introduction

The exponentially growing human population presents a global challenge in terms of the future provision of adequate food, shelter and a healthy lifestyle. The struggle is compounded when one considers the imperative need to preserve the environment and the Earth's natural resources for future generations. Sustainable food production and environmental stewardship must be aimed to address food security and preservation. Addressing this will require a collaborative One Health effort, focusing on the fitness of people, animals and the environment since they are inseparably linked and cannot be considered individually. The quality of available food is a significant cause for concern for the growing human population. Therefore, the gravitation towards organic foods worldwide can be easily understood. The demand is mainly fuelled by consumers in developed nations, whose unease stems from indiscriminate and large-scale use of chemical fertilizers, pesticides, etc., in traditional agricultural practices. Generally, the public in these countries is noticeably choosing organic foods since it is perceived as a safer and healthier alternative (1). There is also an insight that organic farming is a more sustainable agricultural practice, is better suited for environmental health and aids in climate guard and overall animal well-being (2, 3). It is also thought that a large-scale move towards organic agriculture will aid in reducing worldwide hunger (4). Surveys have also shown that consumers feel food security is threatened by excessive use of chemicals and genetically modified organisms (GMOs). In contrast to the consumers of developed nations, most consumers in developing nations are still ignorant about the benefits of organic agriculture. Nevertheless, there has been a shift towards organic foods by the well-off consumers in these countries, possibly due to European influence (5, 6). Incongruous viewpoints exist for organic agriculture and its role in sustainability, where some regard it as ineffective while others visualize considerable benefits (7–11).

Apart from trying to fulfil the growing nutrition needs of an increasing human population, plant products are also used as energy sources. The mounting demand for improved crop yields has led to an augmented use of chemical fertilizers and better plant varieties, including GMOs. These steps have improved agricultural productivity and marked the fulfilment of the green revolution (12, 13). Despite these advances, hunger persists in most of the poorest countries in Asia and Africa (14, 15). Food requisitions will only increase in the coming years based on projections of an escalating world population and incomes. To satisfy these demands, agricultural output needs to improve by a minimum of 60 % and a possible 100 % by the year 2050 regardless of the scarcity of crucial natural resources such as land and water (16, 17). Attention also needs to be paid to avoiding further environmental degradation while addressing the growing food security concerns of the world (18). Prevention of further ecosystem damage should be of paramount importance and the adoption of methodologies to improve food security should be cognizant of these factors (19–22). These issues raise the question of whether organic farming is the future of sustainable agriculture that will address the ever-increasing food needs of the world. This review is, therefore, an attempt to answer this question by analyzing the available literature on the topic and focusing on understanding the different modalities of certified organic farming, along with its impact on the economy, environment and human health.

The legacy of the Green Revolution: achievements and challenges

Green revolution technologies enabled several countries to rise from food deficit situations to increased agricultural output, self-sufficiency, improved food exports and an increase in agriculture-based income (23). However, to attain these goals, most of these countries ended up producing lower-quality food and suffered environmental degradation predominantly due to pollution stemming from the indiscriminate use of chemicals necessary for high agricultural productivity.

Many health concerns have also been raised due to the use of green farming methodologies. These include hormone imbalances, cancers, respiratory issues, birth defects, etc. Chemical fertilizers augment nitrate levels in groundwater, as shown by a study of wells in Kalpitiya where only 56 % of the wells, as per WHO standards had safe drinking water (24). High nitrate levels were also seen in some vegetables mostly due to contamination of soil from shallow nitrate-polluted groundwater sources. These pollutants ultimately destroy and damage natural ecosystems. It is, therefore, time to digress from conventional, chemical-intensive farming methods and shift to practices aimed at restoring declining soil fertility and ensuring food security and availability of resources for future generations (25).

Organic farming systems

The shift towards organic farming practices was first seen in some European nations, mostly in response to the overuse of chemical fertilizers in agriculture. It was encouraged by agriculturists who advocated traditional farming practices based on biological control methods (26). Even though the movement was small for a few decades, it slowly gained momentum in the 1970s, largely due to increasing public awareness and health concerns about the overuse of chemicals in conventional agriculture (27). Eventually, some developed nations started subsidies for organic farming along with certifying organic produce. The United States and EU eventually formulated regulations, policies, standards, labelling, research and sponsoring of organic produce. Organic farmers were praised for their environmental consciousness and offered compensation for increased production costs associated with organic farming (28). Recently, developing nations have also joined the organic farming revolution by adopting policies that support organic farmers.

As per the United States Department of Agriculture (USDA), organic farming is "a system which avoids and largely excludes the use of artificial inputs". It primarily banks on the use of biological control methods, manures from animals and organic farm waste and rotation of crops to maintain soil fertility and nutrient input (2). These practices favour plant, animal and soil health and aid in maintaining more robust ecosystems (29). The subsequently increased agroecosystem resilience helps in combating the detrimental consequences of climate change thereby promoting ecological restoration. Organic methodologies benefit the health of their consumers by providing plant and animal products that are free from chemicals such as pesticides, drugs and antibiotics (30–32). These have a positive impact not only on the end users but also on slowing the propagation of antibiotic-resistant bacteria. Organic practices also contribute to improved biodiversity as farmers depend on pollinators and biocontrol agents to manage crop production (33).

Sustainable agriculture should support both the economy and the environment. As a farming practice, it should provide solutions for the concerns being raised by conventional farming techniques. In this respect, organic agricultural processes fulfil most of the demands required for attaining sustainable food production (27, 34, 35) (Fig. 1).

Global adoption of organic farming

Organic farming is a rapidly growing agricultural category that contributes to about 1 % of the world's total agricultural area. In its present form, organic farming originated in the early 1970s even though it is an age-old form of agriculture that was practised quite commonly in Asian countries like Sri Lanka, which have been known to produce staples such as rice using organic farming methods (36). Today, both Governmental and private standards exist for organic agricultural practices (37). These are built on the standards formulated by the International Federation of Organic Agriculture Movements (IFOAM) (https://www.ifoam.bio/news/global-organic-area-grows-more-ever). These standards are quite comparable worldwide but may have regional differences. They cover all aspects of organic farming related to crops, livestock, aquaculture etc. They also state the actions that are favoured as well as those that are restricted in organic farming (Fig. 2). Some examples of necessary actions include rotation of crops with legumes and mixed crop farming to balance and recycle nutrients and applying only organic fertilizers. The use of chemicals in any form is strictly prohibited. Similarly, in the case of livestock, only organic fodder must be used to feed the animals possibly from the farm where they are being raised and have access to open spaces.

Accredited certification is required to ensure compliance with organic standards and farm inspections should be done on an annual basis (37). It is therefore imperative to keep records of all farming activities. Certification, in developed countries, is mostly done for singular farms while it is carried out in groups in developing nations. This helps reduce the cost for farmers and certifiers (38, 39).

Even though the global area under certified organic

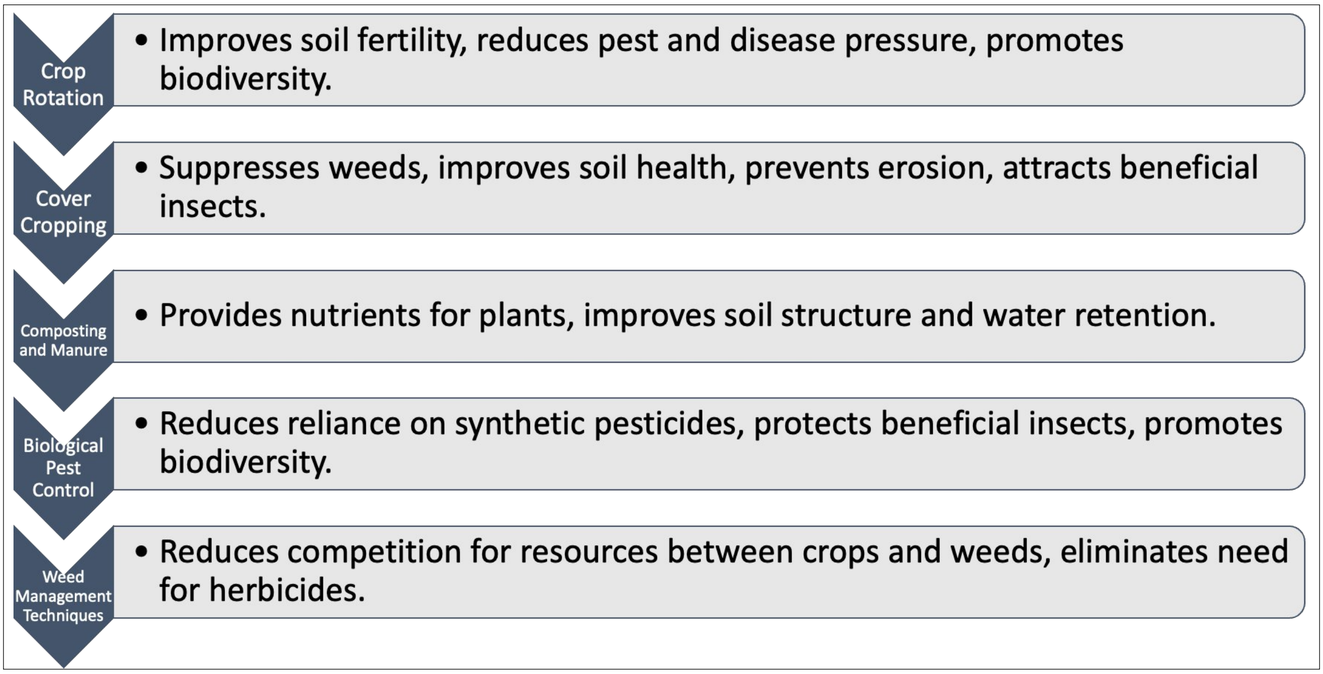

Fig. 1. Cultivating a sustainable future: exploring the practices and benefits of organic farming.

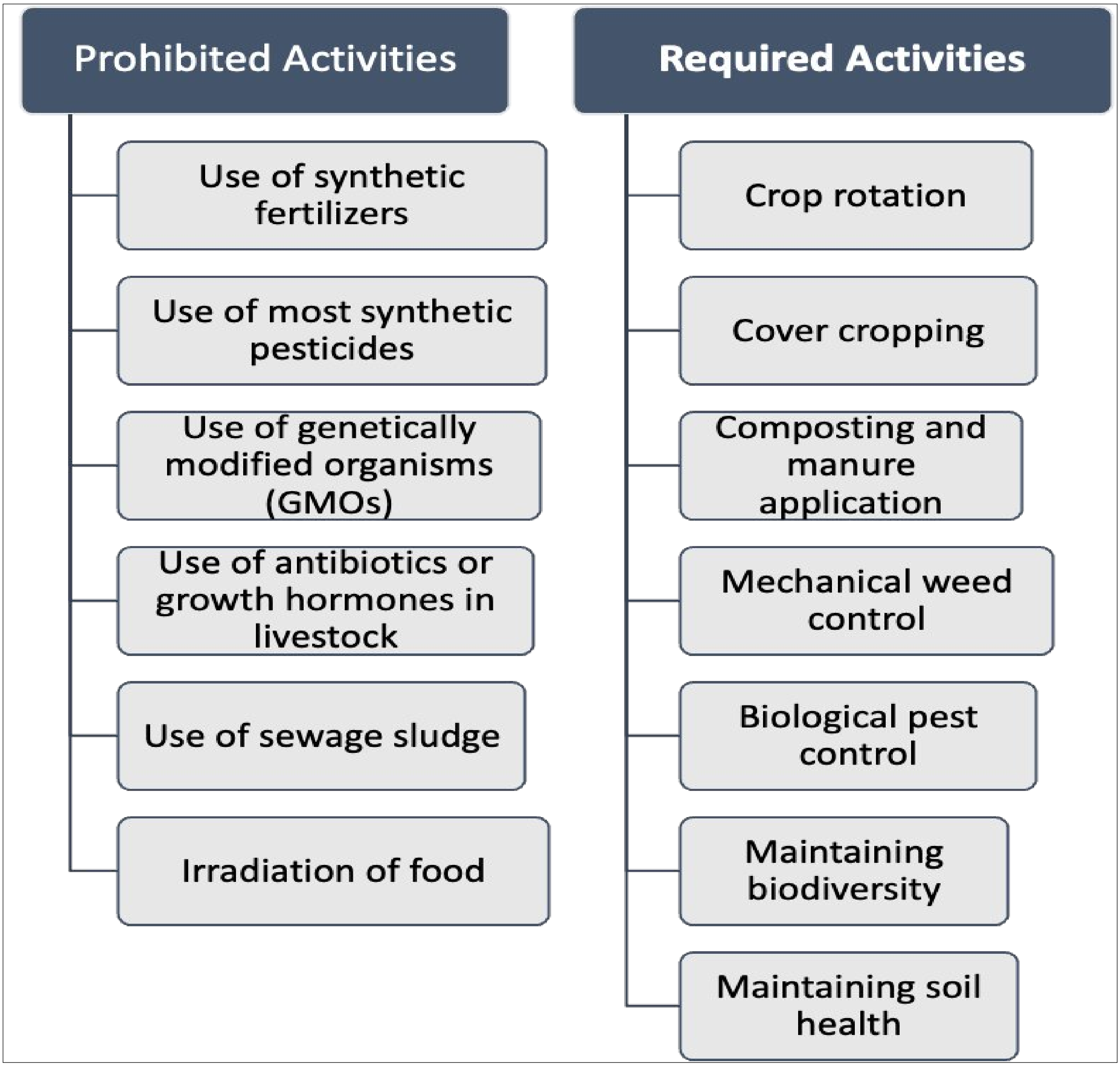

Fig. 2. Prohibited and required activities in organic farming.

agriculture has grown immensely over the past couple of decades, from 15 million ha in 2000 to 96 million ha in 2022 (Fig. 3), it still accounts for just 2 % of the total agricultural land area worldwide. Organic farming lands are expanding worldwide, with a presence on all continents. Oceania boasts the largest share of organic farmland, covering an impressive 53.2 million ha, which is over half of the total global land area. Europe comes in second with 18.5 million ha under organic management. Latin America follows closely behind with a significant area of 9.5 million ha dedicated to organic farming (Fig. 3). The number of organic producers skyrocketed in 2022, reaching nearly 4.5 million globally, reflecting a significant increase of 25.6 % compared to 2021. Asia, Africa and Europe dominated the organic producer landscape, accounting for almost 93 % of all producers. India emerged as the leader boasting an impressive 2.5 million producers in 2022, followed by Uganda and Thailand. While growth was observed in Oceania, Europe and Asia, the numbers declined in Latin America, North America and Africa in 2022 (40).

The organic market globally, reached around 135 billion euros in 2022, reflecting growing consumer interest in organic products and aligned with the increased global area of its production as per the FiBL survey. The United States remained the world's leading organic market, with sales reaching 56.6 billion euros. While some European countries saw a decline in sales, Germany (15.3 billion euros) remained a strong market and China (12.4 billion euros) emerged as the new number 3. Certain countries such as Canada, Japan and Estonia showed positive growth trends. Canada and the United States experienced positive growth in retail sales, indicating continued consumer demand for organic options in these regions. Most European countries spent a larger portion of their incomes on organic food and certain European countries such as Denmark, Austria and Switzerland improved their organic food share to around 11.2 - 12 % of the total food market (40). Switzerland held the title for the highest per capita spending on organic food, averaging 437 euros per person while Denmark retained a large 12 % share of organic products, in its total food market. On the other hand, the demand for organic food and animal produce remains contained to a small high-income section of society in the developing nations due to its significantly higher price (37, 41).

Medicinal and aromatic plants showed the highest percentage increase in organic area (81.5 %) between 2021 and 2022 while berries and olives exhibited the most significant decrease in organic area in 2022 compared to 2021. Nut production has steadily increased in organic area over the past decade (181.2 %). Overall, the total permanent organic cropland area has increased slightly (0.8 %) between 2021 and 2022. However, compared to 2013, there's a significant increase of 96.0 % (Fig. 4) (40). Government subsidies, ability to withstand higher production risk, access to correct information and marketplaces with consumers willing to pay the higher price associated with organic products are some key factors motivating farmers to shift to organic farming (42–46). Organic farming also comes with its own constraints such as prohibiting the use of chemical fertilizers and pesticides and policy risks which further reduce its wide-scale adoption (44, 47). These issues can be mitigated by providing proper training, support and subsidies to farmers, particularly in developing countries, to ensure its wider acceptance (48).

Shifts in farming practices

Modern farming practices can significantly negatively impact our environment and health due to increased greenhouse gases, soil, water pollution, etc. Organic agriculture on the other hand offers a more sustainable alternative since it helps to reduce carbon emissions, improve soil health, cleanses air and water and supports natural ecosystems. Importantly, organic farming avoids using harmful pesticide residues. The key difference lies in how each method deals with pests, weeds and nutrients. Conventional farming relies heavily on chemical solutions - synthetic pesticides, herbicides and fertilizers. On the other hand, organic farming prioritizes natural methods

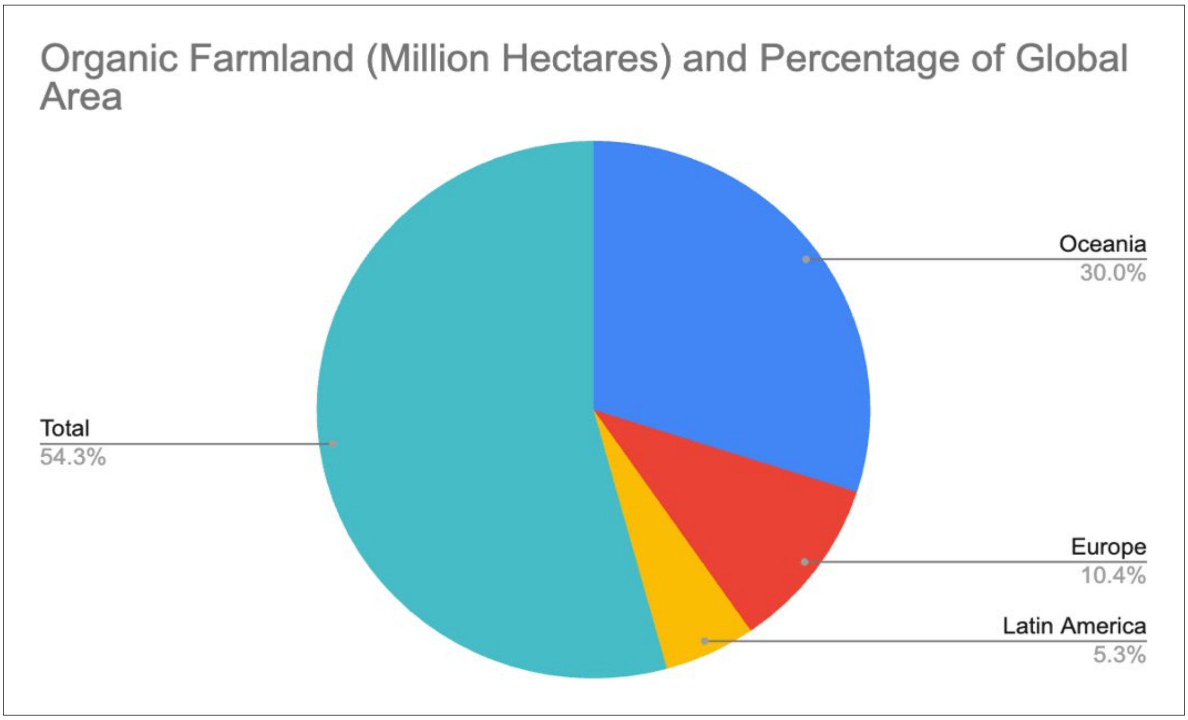

Fig. 3. Organic farmland and percentage of global area (40).

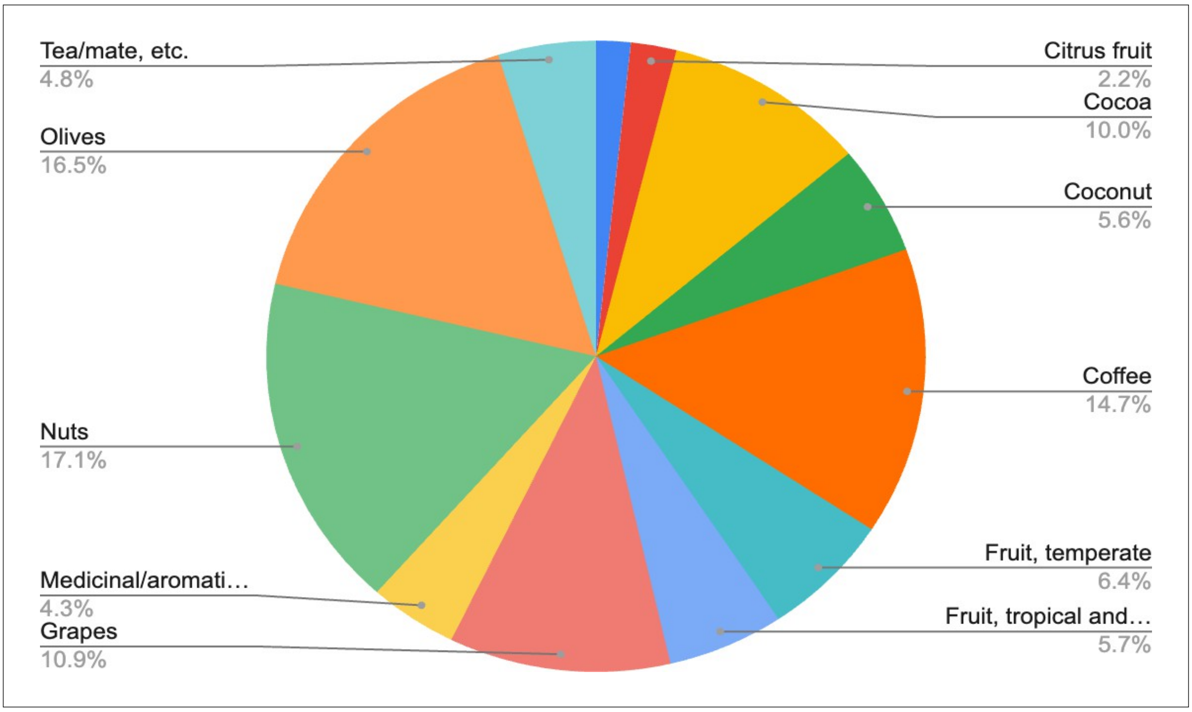

Fig. 4. Comparison of organic permanent cropland between 2013, 2021 and 2022 (Source: FiBL survey 2024, based on information from the private sector, certifiers and governments (40).

like biodiversity and composting to achieve healthy and abundant harvests. Organic farming is more than just saying no to chemicals. It's about reviving ancient practices like crop rotation and using composted manure and green manure crops. Importantly, these methods are adapted for economic viability in today's world. The core of organic production isn't simply replacing synthetic inputs with natural ones. It's about fostering a healthy and balanced ecosystem within the farm itself. Organic farmers employ a variety of techniques to achieve this, promoting biodiversity while ensuring long-term soil fertility (49).

Farming in harmony with nature

Harmonious agricultural practices aim to meet the current population's food needs without compromising on future generations' needs (50). Agriculture greatly impacts the environment and conventional practices can cause widespread deforestation, pollution and soil degradation (51). The advantages of organic farming are manifold and include a reduction in the production and release of greenhouse gases, better food quality due to enhanced polyphenol production in organically grown plants, improved environment and reduced pollution due to the non-use of synthetic fertilizers, soil enrichment due to addition of nutrient-rich composts and crop rotation among others. Apart from these advantages, organic farming also generates rural employment, reduces procurement costs for chemical fertilizers and preserves groundwater resources (52–55).

Organic farming focuses on the rotation of crops, multiple cropping systems, permaculture, integrated farming systems, agroforestry, biological control, etc., all crucial to maintaining sustainability (19). In the long term, the conception of sustainable agricultural mechanisms will help meet the needs of the increasing population, prevent further degradation of the environment and reduce the impact of farming on climate change. In other words, organic farming can be the way forward to move in harmony with nature and equalize society, economics and the environment.

Organic farming: A key ingredient for sustainable global agriculture

Agricultural practices must evolve to align with the United Nations Sustainable Development Goals by 2030 (Table 1). While debating between incremental improvements in agriculture versus transformative changes there is always a focus on different strategies for achieving long-term sustainability goals in the agriculture sector. Incremental steps can provide short-term solutions and build momentum, while transformative changes are crucial for addressing underlying systemic issues and creating a resilient and sustainable food system for the future. Achieving the United Nations Sustainable Development Goals (SDGs) by 2030 will require combining both approaches with the challenge to find a balance between the two so that there are maximum benefits across environmental, social and economic dimensions while ensuring food security and livelihoods for all (56).

The Research Institute of Organic Agriculture FiBL's statistics indicate that the Oceania region consists of Australia, New Zealand and the Pacific Island states. Despite facing numerous challenges such as natural disasters, Australia is notably successful in organic farming and sets an example for other countries. Australia manages most of the organic land in the Oceania region, totalling 35.7 million ha, primarily used for extensive grazing. This accounts for a significant portion of the region's organic land and agricultural lands. It has created a supportive regulatory environment by developing legislation specifically for organic agriculture.

Additionally, several other countries in Oceania have national standards for organic production, although they lack specific legislation. Supportive policies, resilience in the face of challenges and the potential for organic agriculture have contributed a lot to the sustainable development of Australia. Other countries can enhance their organic farming sectors and

Table 1. Organic farming and the sustainable development goals (SDGs)

SDG	Themes	How organic farming contributes	Reference
SDG 2: Zero hunger	Ams to end hunger, malnutrition and provide universal access to safe, nutritious and sufficient food throughout the year.	Improves soil health and fertility, leading to long-term food security. Promotes biodiversity, which increases resilience of crops to pests and diseases. Encourages production of diverse and nutritious crops.	(15, 123-126)
SDG 3: Good health and well-being	Ensure healthy lives and promote well-being for all at all ages	Reduces exposure to harmful synthetic pesticides and fertilizers, promoting public health. Encourages consumption of fresher, more nutritious food	
SDG 6: Clean water and sanitation	It aims to provide clean water, hygiene and sanitation for all	Reduces water pollution from agricultural runoff of chemicals. Promotes water conservation practices	
SDG 8: Decent work and economic growth	Promoting sustainable, inclusive economic growth and full productive employment for all	Creates new job opportunities in organic farming and certification. Supports fair trade practices for farmers	
SDG 12: Responsible consumption and production	Ensure sustainable consumption and production patterns	Reduces the environmental impact of food production. Promotes local food systems and reduces food waste	
SDG 13: Climate action	Take urgent action to combat climate change and its impacts	Reduces greenhouse gas emissions associated with conventional agriculture. Builds soil health, which helps to sequester carbon	
SDG 15: Life on land	Promotes the sustainable use of terrestrial ecosystems. Withstand desertification and reverse land degradation. Protect, restore and sustainably manage forests and biodiversity	Promotes biodiversity in agricultural ecosystems. Reduces soil erosion and promotes soil health	

achieve similar successes in promoting sustainable agriculture and food systems by following Australia's approach.

Cultivating a sustainable future: The synergy between organic farming and sustainable development

Agriculture is widely acknowledged as crucial for achieving sustainable development over the long haul. Integrating small- scale farmers in developing nations into the transformation of agrifood systems is essential for achieving the Sustainable Development Goals by 2030, as emphasised by FAO (56). Goal 2 of the 2030 sustainability agenda, aimed at ending hunger, underscores the central role of agriculture. Additionally, agriculture contributes, to varying degrees, to all other Sustainable Development Goals. The initial Green Revolution was prompted by a rising number of undernourished individuals, leading to the global spread of agricultural technologies such as pesticides and fertilizers to developing nations (57). Despite the initial adoption of sustainable farming practices during this period, their implementation was inconsistent. While chemical inputs contributed to increased yields worldwide, concerns about the environmental and human health impacts of intensive chemical farming spurred the emergence of modern organic farming. Organic agriculture gained momentum in the 1970s in response to growing awareness of the harmful environmental effects of industrial pesticides and fertilizers.

Numerous organisations and member states have endorsed the "Zero Hunger Challenge" in alignment with United Nations Sustainable Development policies (18). This initiative aims to achieve zero undersized children under the age of two, 100 % year-round adequate food, sustainable food systems, a 100 % increase in income and smallholder productivity and zero food waste. Promoting sustainable development through agriculture has predominantly been associated with organic farming. However, despite its global popularity, sustainable organic agriculture faces challenges and limitations.

The greening wave: emerging trends in sustainable organic farming

Organic agriculture, a leading and rapidly expanding movement in sustainability, is also referred to as regenerative farming. It lies at the core of many emerging food and beverage sustainability initiatives. This approach aims to phase out synthetic fertilizers, enhance agricultural productivity and yields, promote biodiversity, conserve water and sequester carbon in the soil. Aligned with organic farming practices, the merits of organic farming encompass integrated pest management (IPM) to reduce pesticide usage, crop rotation, planting nitrogen-fixing cover crops and implementing mulching to enhance soil health (58). Additionally, adopting no-till or reduced-tillage methods reduces soil compaction. Precision farming, guided by soil analysis, optimizes the application of organic and synthetic fertilizers, while innovative irrigation systems maximize yields and minimize water wastage, erosion and salinization (52, 53, 59–61). These practices safeguard soil health and biodiversity and mitigate the environmental impacts of agriculture. Organic farming is increasingly valued for its health benefits and environmental stewardship. Consumer preferences for organic products, driven by health concerns and ecological consciousness, have led to greater willingness to pay premium prices for organic produce, further supporting sustainability efforts.

The seeds of success

Uncaptured yield potential

An important aspect in evaluating the potential of organic agriculture to contribute to sustainable development is its yields, compared to conventional farming. Estimating the yield influences of organic measures is challenging due to the need to account for various confounding factors. For example, if organic farmers achieve lower yields, it could be attributed to their farming methods, but it is also plausible that these farmers are less skilled or work in less favourable environments. In such cases, organic farming might appear to have a wider yield gap even if both groups used identical technology. Conversely, it is conceivable that organic farmers are consistently more skilled than their peers, leading to an underestimation of the yield gap when directly comparing observed organic and conventional yields. Remarkably, there has been relatively little research attempting to address selection biases in the observational data when estimating the yield impacts of organic farming.

However, many studies have endeavoured to evaluate the yield impacts of organic farming based on the data derived from trials conducted at experimental sites. Experimental data are advantageous for minimising bias from confounding factors, but can pose challenges in generalizability (as discussed later). The outcomes of these studies exhibit considerable variability depending on specific conditions. In some instances, organic yields have been documented to exceed those of conventional farming, whereas in others, they were significantly lower. Several review papers have recently sought to synthesise the available evidence on this topic. Initially, research indicates that a pioneering study compiled data from various sources. They concluded that globally, organic agriculture showed an average crop yield 33 % higher than conventional methods. Organic yields in the developed countries were reportedly 9 % lower than traditional yields, whereas in the developing countries, organic practices potentially increased yields by 74 % (10). Nonetheless, this study received significant criticism on multiple fronts (62–64). Critics pointed out that many studies included in Badgley et al.'s review did not comply with the basic scientific standards of experimental design and that other appropriate studies were overlooked (62, 64). Specifically, regarding developing countries, research shows that crops receiving substantial organic nutrients with those receiving minimal or no conventional fertilizer.

As a result, despite its widespread citation, the findings of a study are viewed sceptically and may not be considered reliable or robust in their implications (10). In recent years, three meta-analyses have provided more robust scientific comparisons of organic and conventional crop yields (65–67). These meta-analyses (Fig. 5), reveal that organic agriculture generally exhibits yield gaps ranging from 19 - 25 % across various crops. Variations are notable among different types of crops: fruits and legumes show lesser yield gaps when compared to cereals, tubers and root crops. Some indication is there that the yield gap widens with the increase in the conventional yields (65). Optimal management of the 2 systems does not significantly alter the yield gaps between the developed and developing countries (66). However, it is crucial to note that observations from developing countries are notably underrepresented in all three meta-analyses, requiring caution when interpreting statements about geographic variations in yield gaps (2).

Recent initiatives have begun addressing, through longer-term research efforts, the productivity impacts of organic farming in developing countries (68). A key problem in comparing yield levels between conventional and organic agriculture is the time frame covered by the original studies. There is a widespread assumption that yields may initially decline after transitioning to organic practices, but due to improved soil conditions, they could recover over time. The evidence supporting this assumption is, however, limited. Some studies indicate increasing organic yields over time; others report no change or even declines during long-term assessments (65, 69).

Bridging the harvest gap

Besides sunlight and optimal temperatures, plants necessitate a diverse array of nutrients for robust growth, like, phosphorus, nitrogen, potassium and various micronutrients. Soil texture, composition, water availability and challenges related to pests

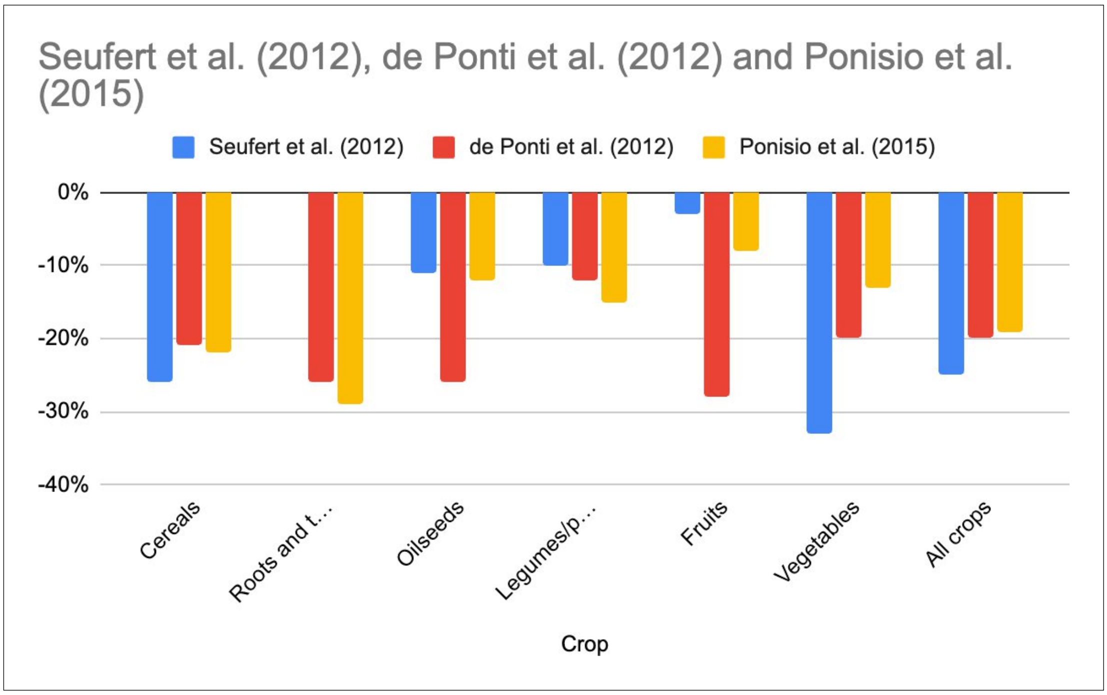

Fig. 5. Mean organic crop yields in comparison to conventional yields (results from global meta-analyses).

and diseases are also pivotal factors. These factors can vary between organic and conventional farming, leading to differences in yield. Organic farming standards, for instance, ban synthetic fertilizers. While organic fertilizers can theoretically provide all necessary nutrients, managing these nutrients in organic systems can be more complex (70). Organic farming often struggles with the availability of nitrogen and phosphorus (71, 72). Nitrogen from organic sources is released gradually, which can fall short of meeting the crop's needs during critical growth phases (67). Likewise, phosphorus in organic setups may be insufficient to replace what is lost during harvest (72). Overall, achieving the optimal nutrient balance for plant growth is more challenging in organic systems because of the limited ability to modify the nutrient content of organic inputs (2).

Nutrient limitations are key in explaining the yield differences seen in organic farming. This helps clarify why yield gaps are smaller for fruits and legumes. Legumes can fix atmospheric nitrogen, reducing their dependence on external nitrogen inputs. Similarly, fruit trees, with their longer seasons of growth and elaborate root systems, are better able to take up nutrients in alignment with their growth needs (67). Regarding usage and availability of water, organic farming often holds an advantage due to the improved water-holding capacity and increased water infiltration rates observed in soils managed with organic practices. This contributes to the perception that organic systems are more robust and exhibit greater yield stability, especially during drought (72, 73). However, organic systems can be more vulnerable to pest outbreaks, leading to yield losses and increased variability (2). The prohibition of GMOs and synthetic pesticides in organic agriculture limits farmers' options for managing insect pests, weeds and plant diseases. Therefore, in regions with high incidence of pests, biological control methods struggle against persistent pests and diseases and the yield gaps in organic farming tend to be larger.

Real-world relevance of estimated yield gaps

Most comparisons of crop yields between organic and conventional agriculture are drawn from experimental trials conducted at research sites. These trials often show higher yields than seen in actual farming as farmers may not always implement the suggested management practices exactly. The comparisons would be fair if the yield discrepancies between research stations and real-world farms were similar for both organic and conventional systems. However, evidence indicates that the yield gap between research trials and farmers' fields is greater in organic farming than in conventional farming (74). This is primarily due to the increased complexity and knowledge requirements of organic farming, where yields are more dependent on timely interventions (67, 75). Thus, although the reported differences between organic and conventional farming yields may be accurate under experimental conditions, they likely undervalue the actual yield gaps seen in real-world farming scenarios.

A study aimed to validate findings from experimental stations by comparing data from multiple commercial farms across the United States (76). Their study revealed that organic farms generally achieved cereal yields about 20 % lower than conventional farms, consistent with existing meta-analyses. However, they noted yield differences of over 50 % for certain vegetables, which exceeded previous meta-analytical estimates. In practical European contexts, a study reported even larger yield gaps, with organic cereal yields sometimes dropping by 50 % compared to conventional methods (77). Nevertheless, it is essential to approach these findings cautiously due to the limited availability of comprehensive and impartial evidence on organic yield impacts in actual fields (74, 78). Moreover, considering the higher expertise required for the success of organic farming, there is a possibility that yield gaps could widen with organic practices becoming more widespread among farmers.

Another exciting aspect is the way the yield disparities between organic and routine agriculture might evolve over the long term, especially considering technological progress. Current research does not definitively answer this question (2). It is recognized that yield gaps tend to widen as conventional yields increase. Looking forward, these gaps could widen further due to slower advancements in plant genetics. Organic standards prohibit the usage of genome editing techniques and GMOs, which are known for their ability to boost crop yields and resilience significantly (13). Conversely, organic farming has historically received less research attention and increasing research efforts could potentially help reduce these knowledge gaps over time (72).

Organic food: A source of dietary advantages?

Consumers frequently believe that organic foods offer superior nutritional value and health benefits than conventional foods (37). This perception may be influenced by the assumption that organic products have lower harmful contaminants or higher amounts of beneficial nutrients. Numerous studies have investigated whether significant variations exist in the chemical composition between organic and conventional foods. Multiple systematic reviews have found that lower levels of residues of synthetic pesticides are generally found in organic foods (79–81). The effect of this difference on human health depends on the types and quantities of pesticides used in conventional farming. The risk of exceeding maximum allowable limits is typically low in developed countries with stringent pesticide regulations (82, 83). Additionally, organic foods often contain lower concentrations of nitrate and cadmium than their conventional counterparts (80, 81). Studies typically do not reveal significant differences in microbial–bacterial or fungal contamination, however, some indicate microbial load in certain organic fruits (84).

Systematic reviews have indicated that slightly higher levels of nutritionally beneficial components, phenolics are often found in organic plant products (81, 83, 85). Findings regarding carotenoids and vitamin C varied across studies (81, 83). Organic milk and chicken are reported to have elevated omega-3 fatty acid levels (80, 81, 83). Conversely, organic foods generally exhibit slightly lower concentrations of proteins and amino acids (81). Nevertheless, the clinical relevance of these variances in nutritionally beneficial components between organic and non-organic foods remains uncertain (79, 81, 83, 86). Variances in the organic and non-organic foods compositions is expected due to the influence of farming practices on plant chemistry (85). Organic plants typically exhibit lower levels of cadmium and nitrate, which is attributed to the absence of synthetic fertilizers in organic farming (81). The use of nitrogen fertilizers in conventional farming by focusing on proteins and carbohydrates enhances vegetative growth and limits generative growth, which involves the production of secondary metabolites (80). In animal products, enhanced levels of omega-3 fatty acids are often linked to outside grazing and greater biodiversity in the organic farms' pastures.

The chemistry of the plants is influenced by the production system and factors such as soil type, weather conditions, ripening stage at harvest, postharvest conditions and genotype (variety) also have an impact on it (80, 85). Cadmium levels, for example, vary significantly depending on soil type, potentially resulting in elevated levels in organic products (81). Moreover, management practices differ widely (80, 83). For example, organic cattle may not always graze on biodiverse pastures and conventional cattle are not necessarily confined and fed silage. Thus, there can be greater variation in food composition within organic and conventional systems than between the two (85). Numerous studies have explored the potential health effects of organic diets. Some studies have revealed that in infants, a lower risk of eczema and allergies is associated with consuming organic foods (87, 88). Additionally, a cohort study conducted in France showed a reduced incidence of obesity due to regular organic food consumption (89). A systematic review, however, concluded that there are no significant differences in health outcomes related to organic food consumption (79).

Establishing causality with observational data is difficult because organic consumers often make distinct, typically healthier, lifestyle and food choices potentially introducing selection bias in impact assessments (80, 89). Due to these complexities and the limited evidence available, definitive conclusions about the effect of organic food consumption on health cannot be universally established (79, 81, 86).

Growing green: how organic farming impacts the environment

Agricultural production is known as a significant contributor to many environmental problems like water pollution, soil degradation, biodiversity loss and climate change (18). There is an accepted belief that organic agriculture produces less adverse impact on environmental when compared to conventional agriculture. This belief is a key rationale for governmental subsidies allocated to support the organic sector. Here, we look at the evidence of effects of organic farming on various environmental factors.

Optimizing land use

Roughly two-fifths of the ice-free land, globally, is currently under agricultural production (18). Ongoing changes in land usage, such as deforestation, are linked to many environmental challenges, including biodiversity loss and the release of soil carbon into the atmosphere. Therefore, achieving a balance between food production and environmental conservation will depend on more efficient land use and utilization of natural resources. The assessment of environmental impacts in both organic and conventional production systems crucially relies on understanding their respective land-use requirements. Thus, impacts on the environment are evaluated per unit of land and per unit of output. The output measure reflects the lower land-use efficiency observed in organic systems. As global food demand rises, evaluating impacts per unit of output becomes increasingly relevant on a global scale. However, this approach may not fully capture the environmental impacts of widespread adoption of organic agriculture.

Currently, a small portion of global agricultural land is certified organic. Expanding organic agriculture would likely necessitate transitioning natural habitats into agricultural use. This shift in land-use would carry environmental costs that are often overlooked when evaluating the impacts based solely on output per unit (78). Thus, while measuring evaluating impacts per unit of output provides a useful metric, it may overlook broader ecological implications associated with large-scale expansion of organic farming.

Sustainable practices for energy and emissions

Food production contributes to approximately 25 % of human- caused greenhouse gas (GHG) emissions (90). These emissions, which include nitrous oxide (N_2O), carbon dioxide (CO_2) and methane (CH_4), arise from several sources such as fossil fuel combustion (used for mineral fertilizer production and agronomic machinery), animal digestion and soil chemical processes (73). Assessments of energy consumption and GHG emissions in agriculture generally encompass the production process of a product until it leaves the farm (91, 92).

Research indicates that organic farming generally requires less energy/unit of land and per unit of output than conventional farming (Fig. 6). This difference is mainly because organic systems do not use synthetic fertilizers and pesticides. Fuel consumption for agricultural activities is generally comparable in both systems. However, organic farming, particularly for crops like vegetables, may require more fuel due to the frequent use of mechanical or thermal methods for weed control (91, 93, 94). In certain situations, this can increase total energy consumption in organic systems (95). Regarding greenhouse gas (GHG) emissions, most of the studies suggest that organic farming generally has a lower impact when stated per unit of land, though not necessarily when assessed per unit of output (Fig. 6). Organic systems typically use less nitrogen, which reduces the potential for nitrous oxide (N_2O) emissions. However, achieving a balance between nutrient availability and plant requirement is often more complex in organic systems. Excess nitrogen from organic fertilizers can cause substantial N_2O emissions and insufficient nitrogen supply can lead to reduced yields (94, 96, 97).

In crop production, organic systems have been found to exhibit significantly higher soil carbon stocks and sequestration rates compared to conventional ones (98, 99). Conversely, in livestock production, less intensive organic animal husbandry practices generate more manure per unit of meat, resulting in increased methane (CH_4) and nitrous oxide (N_2O) emissions (100). Overall, the evidence does not strongly support the common belief that organic agriculture is inherently more climate-friendly than conventional farming

(101). The comparison of GHG emissions per unit land versus per unit output underscores the complexities involved in assessing the environmental impacts of different farming systems.

Minimizing nutrient loss: strategies for cleaner water

Nutrient leaching poses a significant environmental challenge, particularly in intensively farmed regions, as it contributes to water body eutrophication and marine ecosystem degradation (102). Under organic management, nitrate (NO_3^-) leaching has been observed to be lower per unit of land and not per unit of output (Fig. 6). Interestingly, organic systems tend to have higher eutrophication potential per unit of output, measured in phosphate (PO_4) equivalents, as well as more significant acidification potential, measured in sulphur dioxide (SO_2) equivalents, compared to conventional systems (97).

The absence of synthetic fertilizers in organic farming typically causes decreased leaching potential (70, 99). However, the challenge of matching nutrient supply with plant requirements in organic systems can lead to increased loss of nutrients (73, 102, 103). Regarding pesticides, prohibiting chemical pesticides in organic farming reduces the adverse effects of pollution in water systems (11). Nevertheless, certain non-chemical pesticides in organic agriculture, such as copper- based solutions in horticultural production, can also adversely affect aquatic life (70).

Soil health: the cornerstone of sustainable agriculture

Millions of hectares of land that were once fertile have become unsuitable for agriculture due to soil degradation, many times exacerbated by poor management practices (102). Organic farming practices, like adding organic matter (animal or plant manure) and implementing extended, more varied crop rotations including cover and catch crops, are crucial in mitigating soil erosion and preventing fertility loss (70, 99). Long-term field trials' findings and meta-analyses consistently demonstrate that organically maintained fields have higher levels of organic matter and support more diverse and active soil microbial communities (Fig. 6), the key indicators of soil health.

Nature's web of life

The widening and standardization of agricultural scenarios have markedly caused the decrease in biodiversity (102, 104). A widespread consensus is that organic farming promotes greater biodiversity attributed to less pesticide use, extensive crop rotations and semi-natural landscape elements like hedges (69, 70, 77, 105–107). Meta-analyses indicate that organic farms consistently exhibit higher species richness and greater species evenness than conventional farms (refer to Fig. 6). Significant differences are particularly evident when compared with highly intensive conventional systems (99, 104). However, the biodiversity advantages associated with organic farming diminish as its intensity increases (108). Ongoing discussion exists regarding whether these benefits also decline with farm scale (99, 104, 106).

As previously discussed, expanding large-scale organic agriculture would probably result in reduced yields and further depletion of natural habitats. There is a consensus that while organic farming can enhance biodiversity, these gains are unlikely to compensate for the biodiversity losses resulting from additional changes in land use (106, 108–110). The debate between "land sharing" and "land sparing" is multifaceted and demands tailored solutions for specific locations, making

SUSTAINABILITY METRICS

	Land use	Energy use	Greenhouse gas (GHG) emissions	Nutrient leaching/eutrophication potential	Soil quality	Biodiversity
Per unit of land	Not applicable	Energy use 10-70% lower	Nitrous oxide emissions 14-31% lower [a,c] GHG emissions 39% lower	Nitrate leaching 30-31% lower [a,c] Ammonia emissions 18% lower Phosphorus losses 1% lower [a]	Soil organic matter 6-7% higher [a,c,g] Larger and more active soil microbial communities	Species richness 30-34% higher [h,i] Organism abundance 50% higher [h] Species evenness higher [k]
Per unit of output	Land use 20-110% higher [a,b,c] Land use for organic diets 40% higher [d]	Energy use 15-21% lower [a,b]	Nitrous oxide emissions 8% higher GHG emissions 0-10% lower [a,b,c] GHG emissions of organic diet equal to conventional diet [d]	Nitrate leaching 5% lower globally and 49% higher in the EU Ammonia emissions 11% higher Acidification potential (sulfur dioxide equivalents) 13% higher [b]	Not applicable	Biodiversity loss through indirect land-use change not evaluated in available studies

Fig. 6. The environmental footprint of food: organic vs. conventional [a]104 [b]98, [c]111, [d]101, [e]141, [f]100, [g]70, [h]105, [i]108, [k]142. Adapted from earlier report (21).

broad global recommendations unsuitable (107, 111).

Organic farming's environmental footprint: a closer look

In general, the environmental benefits of organic agriculture are not as straightforward as commonly assumed. While organic systems often show better environmental performance per unit of land compared to conventional systems, this advantage diminishes when measured per unit of output (Fig. 6). Consequently, organic farming is more appropriate for mitigating local environmental problems such as soil degradation, than addressing global challenges like alterations in land usage and climate change (110). Some findings on environmental impacts remain inconclusive. Limited data from developing countries may restrict the global representativeness of existing results (95-98). Additionally, many studies comparing organic and conventional farming do not sufficiently control for confounding factors, which means observed differences may not necessarily indicate causal effects of organic standards. Also, it is important to recognize that significant variability in environmental effects is there within both conventional and organic systems (92, 96, 99, 100, 102, 105). Organic standards promote environmentally friendly farming techniques, such as effective nutrient management, extended crop rotations and integration of semi-natural landscape elements. However, it should be noted that these practices are also adopted by many conventional farmers (77, 94).

Science meets sustainability: technologies for optimized organic farming

Organic farming is increasingly recognized as crucial for steering towards a sustainable future, mitigating the harmful impacts of crop burning and global warming. Traditional agricultural methods heavily rely on chemical fertilizers and pesticides to address agricultural demands. However, the rise of modern organic farming arose in response to the environmental damage caused by these chemicals, offering manifold ecological advantages. Integrating organic fertilizers with cutting-edge technologies is pivotal in overcoming the constraints associatedwith organic farming.

Sludge: waste-to-resource solution

Sludge is a semi-solid blend generated from wastewater treatments, industrial water, or on-site sanitation measures. It includes beneficial organic matter and key nutrients, like phosphorus and nitrogen, making it well-suited for soil amendment or organic fertilizer application. Table 2 details studies investigating sludge utilisation from wastewater treatment plants as an organic fertilizer.

The dynamic duo: biochar and organic fertilizer for thriving soil

Biochar originates from carbon-rich biomass sources, such as animal, food, industrial wastes, wood chips, sludge and agricultural and forestry residues, each exhibiting varied chemical and physical attributes. Biochar production involves several technologies, such as pyrolysis (slow, fast and intermediate), torrefaction, gasification, hydrothermal and flash carbonization. Among these, pyrolysis is the most widely used method for converting biomass into biochar (112).

Applying organic fertilizer and biochar amendments in agriculture is intended to enhance soil properties and increase crop yields. Research highlight the crucial role plant roots play in overall plant functions, noting that the addition of organic fertilizers and biochar affects root morphology and physiology, although the precise responses are not yet fully understood (113).

A previous study suggest that compost made from anaerobically digested rice straw and urea coated with rice husk biochar substantially improve soil nutrient content (114). Moreover, combinations of biochar with fertilizers, whether chemical or organic, demonstrate enhanced performance compared to using fertilizers alone, improving crop yield and enhancing plant nutrition. The use of biochar-coated chemical fertilizers also contributes to mitigating water pollution from inorganic fertilizers (114–116).

Biofertilizer: natural soil enhancer

Biofertilizers are formulations comprising of one or many types of microorganisms that enhance the availability of essential nutrients through biological procedures. These processes include soil and compost biodegradation, phosphate solubilization, nitrogen fixation and the release of cellulose or plant growth-promoting constituents into the environment. Typically, biofertilizers consist of living microbial bioinoculants, such as bacteria (e.g., free-living, nitrogen-fixing bacteria like

Table 2. Transforming waste: valuable applications of sludge

The many uses of sludge	Benefits and applications	Reference
Enhances fertilizer effectiveness	Boosts plant growth and reduces overall fertilizer needs	127
Fertilizer substitute	Comparable crop yields to conventional fertilizers	128, 129
Improves nutrient uptake in crops	Micronutrients and nitrogen supplementation for plants	130, 131
Improves soil productivity and crop yields	Enhances soil health and increases agricultural output	132
Nutrient recycling solution	Reduces waste and recovers valuable nutrients for agriculture	133
Organic fertilizer	Sustainable source of nutrients and reduces reliance on non-renewable resources	134
Potential replacement for manure	Alternative nutrient source for organic farming	135
Safe and effective fertilizer	No adverse impacts on plant growth or soil health	136
Source of phosphorus	Reduces reliance on commercial fertilizers	137
Sustainable nutrient source	Replaces commercial fertilizers and improves soil health	138
Sustainable phosphorus source	Reduces the need for mining and offers similar plant uptake efficiency as commercial fertilizers	139, 140

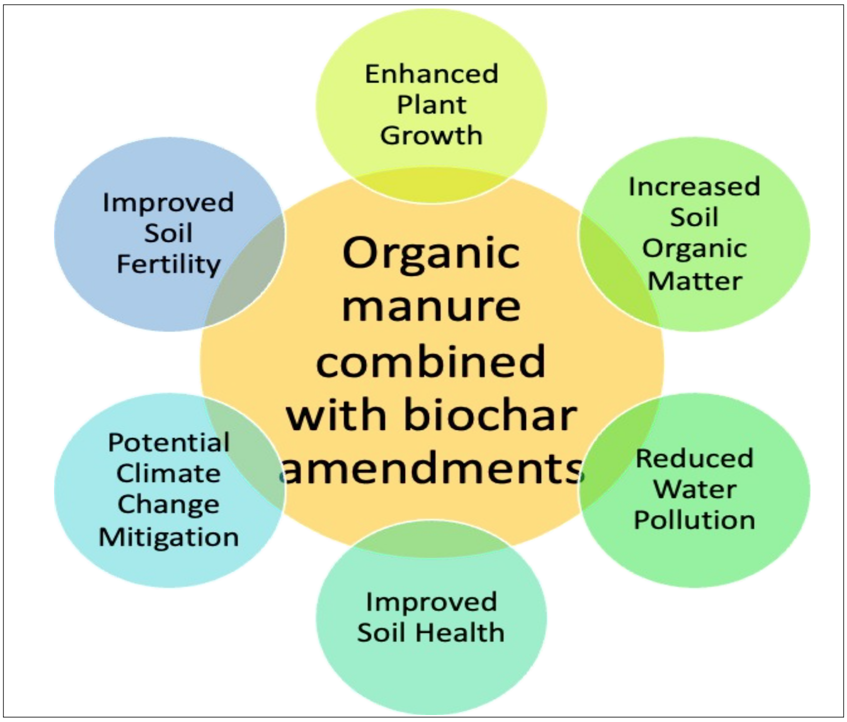

Fig. 7. Supercharging soil: The benefits of combining organic manure and biochar.

Azotobacter and *Rhodospirillum*), algae and fungi, either used individually or together, to naturally improve nutrient availability for plants.

Combining decomposed organic substances with plant growth-promoting microbes promotes eco-friendly practices and reduces reliance on synthetic fertilizers for crop production (Fig. 7). In an earlier study, it was reported that the usage of bio-organic fertilizer not only increased soil organic carbon by 6 - 13 % but also enhanced the population of plant growth-promoting bacteria compared to using chemical fertilizers alone (117). Furthermore, bio-organic fertilizer serves as a sustainable technology, reducing the need for Chemical N by 30 % and eliminating the requirement for TSP (triple superphosphate) in rice cultivation. Biofertilizers play a pivotal role in agriculture by lowering the cost of synthetic fertilizers and minimizing their negative impact on soil health (117). A key element of the sustainable organic farming is mycorrhizae, a symbiotic association between fungi and plants (118).

Vermicomposting harnesses earthworms to transform biodegradable waste into organic fertilizer without requiring pile turning, emitting odours and facilitates rapid compost production. The cultivation of earthworms occurs in a mixture of soil, animal wastes, decomposed leaf litter or agricultural residues. This mixture transforms into vermicompost, suitable for enhancing soil fertility for various plant types. Various approaches involving earthworms demonstrate versatile uses, particularly in aiding composting alongside microbes (119). Their study highlights effective control and reduction of microbes, pathogenic genes and greenhouse gas emissions. Additionally, soil nutrient levels are conserved and enriched. Despite these advantages, composting and vermicomposting technologies still encounter challenges in certain scenarios, prompting the need for continued investigation and discussion among upcoming researchers.

Organo-mineral nutrient supplements

Organo-mineral fertilizers are composed of both organic and mineral elements, formulated in different ratios of nitrogen (N), phosphorus (P) and potassium (K) to suit the specific requirements of crops. The final product can be in granular, pelletized, or powdered form. These fertilizers contribute to soil fertility by enhancing its physical and chemical properties, improving nutrient availability and water retention and aiding in phosphate solubilization. Moreover, organo-mineral fertilizers promote plant agro-physiological characteristics such as higher biomass and production, improved nutrient uptake and enhanced physiological metabolism in plants (120, 121).

Web-based solutions

Digital tools and technology provide organic farmers with avenues to monitor and optimise crop and livestock health, improve efficiency in resource utilization, reduce environmental footprint and boost farm profitability. These technologies can be applied across various aspects of organic farming, like soil preparation, fertilization, irrigation, postharvest handling, storage and transportation of agricultural products. While digital advancements in agriculture are predominantly utilized by large

-scale farmers and contribute significantly to sustainable practices, they also hold potential to alleviate poverty and food insecurity among smallholder farmers worldwide. Yet, digital services designed for small-scale organic farmers frequently lack long-term sustainability. Enhancements in these technologies are essential for fostering economic and environmental sustainability in organic farming (122).

Key findings

Meeting the United Nations Sustainable Development Goals (SDGs) by 2030 requires transforming agricultural practices, a topic of passionate debate. Research and discussions emphasise the need for sustainable agriculture practices and food systems that ensure adequate and wholesome food for all, minimize adverse environmental impacts and enable farmers to achieve profitability. There is consensus that agriculture and food systems need rapid adaptation to meet multiple SDGs within ecological limits. Yet, there is intense debate over the optimal approach, centred on two main strategies: one advocating incremental improvement in conventional agriculture to enhance efficiency and reduce negative externalities and the other promoting radical restructuring towards agroecologically based organic farming systems. Integrating organic farming with improved techniques such as sludge and biochar applications, biofertilizers, organo-minerals and digital technology is crucial for overcoming the constraints of organic farming. This innovative and sustainable approach not only boosts agricultural productivity but also improves the quality of life for many farmers in an environmentally conscious manner.

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Authors' contributions

MAP performed material preparation, data collection and analysis and contributed to writing the first draft of the manuscript. SG performed material preparation, data collection and analysis. MK performed material preparation, data collection and analysis. CDR performed material preparation, data collection and analysis. JK contributed to the study's conception and design, performed material preparation, data collection and analysis, wrote the first draft of the manuscript and commented on previous versions. All authors commented on previous versions of the manuscript and approved the final version.

Compliance with ethical standards

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Dr. Varsha Singh

Committees

1. IQAC - Co-coordinator
2. Medical Committee- Convener
3. Screening Committee for CAS Promotion- Member
4. Research Project Allocation Committee- Member
5. Admission Committee- Member

Workshop/Seminar Organized

1. Organized a Heart health awareness and CPR training workshop as a Medical Committee convener, on 5th November 2024.
2. Organized a Cancer Awareness Seminar on 7th November 2024.

Projects

1. DST-SERB CRG Project on "Functional interaction between ovarian catecholamine and steroids: effect of ovarian denervation in the catfish *Heteropneustes fossilis*"
2. In house Kalindi College Project on "Development of Phage-Insensitive Mutants: Phenotypic and Genotypic Comparative Analysis"
3. In house Kalindi College Project on "Green Synthesis of ZnO Nanoparticles from Leaf Extract of *Ocimum sanctum* and their study against plant fungal pathogens"

Paper Presented

1. Presented a paper titled "Neuroendocrine relationship between Corticotropic and gonadotropic axis with respect to neuropeptides in the catfish *Heteropneustes fossilis*" in International Conference on endocrinology, metabolism and reproduction: exploring new frontiers organized by Department of Zoology University of Jammu, Jammu UT J&K, India on 24-10-2024.

Dr. Tarkeshwar

Individual Achievements, 2024-25

Paper Publication

Sharma, M., **Tarkeshwar**, Singh, A., Kumar, P., Kumar, M. and Kapinder (2024). Potential role of biomaterial-based polymers in pharmaceutical industry. *Biochem. Cell. Arch.* **24**, 13-24. DOI: https://doi.org/10.51470/bca.2024.24.1.13.

Book Chapter

Kapinder, Kumar, A., Deepika, Deepanshi, and **Tarkeshwar** (2025). Role of Nutraceutical Fruits in Gut-Related Diseases. In R. K. Kesharwani, P. Kumar, and R. K. Keservani, *The Nature of Nutraceuticals History, Properties, Sources, and Nanotechnology* (pp. 97-112). USA, Apple Academic Press, CRC. ISBN: 9781774917022 (Hard), ISBN: 9781003518969 (E-Book)

Resource person/Contribution/Organiser

1. Organized a Plantation Drive on the theme "Grow a Tree for Life," an Environmental Action Programme, as IQAC Coordinator in association with Garden Committee on 15-07-2024 at Kalindi College.
2. Organized a seminar and paper presentation competition on the topic "Real Dhan: Human Health-A Step Towards Arogyata" as IQAC coordinator in association with Department of Commerce and Garden Committee on 31-01-2025 at Kalindi College.
3. Organized an "Awareness Campaign and Mammography Screening Camp" as IQAC coordinator in association with Department of Computer Science and on 14-11-2024 in college campus.
4. Organized an invited talk on the topic "*Swatantra Bharat Me Hindi Me Kamkaj Ki Anivaryata*" *(*स्वतत्रं भारत मे हिन्दी मे कामकाज की अनिवार्यता) on 27-02-2025 as IQAC Coordinator in association with राजभाषा का्रायन्वि सममनत (*Rajbhasha Karyanvan Samiti),*
5. Organized an invited talk on "वैश्वीकरण के दौर मे हिन्दी" on 18-09-2024 under the theme *Hindi Pakhwada* (14-09-2024 to 26-09-2024), as IQAC Coordinator in association with Hindi Sahitya Parishad, Department of Hindi.
6. Organized a National Conference on "Sustainable Startups: Integrating Traditional Knowledge with Innovation", on 17-02-2025, as IQAC Coordinator in association with IBSD Committee.
7. Resource person-Project Evaluator at Zonal Maths-Science Fair (Gyan-vigyan mela), on 01-10-2024, organised by Shishu Bharti Vidyalaya, Vidya Bharti, Jhilmil, Delhi.
8. Resource person- Session Chair, for Technical Session of National Conference on *"Punyashloka Ahilyabai Holkar: Empowering Society through Values, Virtues, Compassion, and Leadership",* held from 03-04 February 2025, organized by Department of History, Kalindi College, University of Delhi.

Participation in Seminar/workshop/FDP

1. Completed 10 days Online Certificate Course-cum-Workshop on "MICROSOFT

POWERPOINT USING AI TOOLS" held from 11th-20th December 2024, organized by Sanatan Dharma College, Ambala Cantt, Haryana.

2. Completed 10 days Online Certificate Course-cum-Workshop on "MICROSOFT WORD USING AI TOOLS" held from 1st - 10th January 2025, organized by Sanatan Dharma College, Ambala Cantt, Haryana.
3. Participated in International webinar on "Accelerating Equity in Science (GWB-2025)" held on 11-02-2025, organized by IQAC & Department of Chemistry, Jagat Arts, Commerce & IHP Science College, Goregaon, Maharashtra.
4. Participated in Online Training Programme on "NEP 2020 Orientation & Sensitization Programme" held from 03rd – 11th March, 2025, under MMTTP, UGC organized by Mahatma Hansraj Malaviya Mission Teacher Training Centre (MH-MMTTC), Hansraj College, University of Delhi and Kalindi College, University of Delhi.

Visited as Subject expert/Special Lecture

1. Appointed as Subject Expert & Head Examiner (Evaluation Board) for the Zoology subject at Jharkhand Public Service Commission (JPSC), Ranchi, Jharkhand.

Inhouse Research Projects

1. Title of the Project: "An Assessment based study of Kalindi college Students' health status using behavioural and nutraceutical components as tool"

Member of Learned Body

- Life time member of "Society for Promotion of Education and Science (SPES)", Delhi, India
- Life Member, Himalayan Life Science Society, CUHP, Dharmshala, HP, India.
- Associate Editor 'Editorial Board' of 'Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)' and it's journal(s).
- Associate Editor of 'Editorial Board' of 'Lattice Science Publication (LSP) and it's journal(s).

Administrative Duties/Contribution to Corporate Life of College

1. **Coordinator:** Internal Quality Assurance Cell (IQAC)**,** Kalindi College
2. Public Information Officer (PIO), Kalindi College
3. **Convener:** MIS Committee
4. **Member:** Budget Estimate, Allocation and Expenditure Committee
5. **Member:** Research Fund Allocation Committee, Kalindi College
6. **Member:** Internal Complaint Committee, Kalindi College
7. **Member:** Space and Infrastructure Committee
8. **Member:** Academic Committee, Kalindi College
9. **Member:** Research Committee, Kalindi College

Achievements 2024- 25

Dr. Mayanglambam Rojina Devi

Assistant Professor

Zoology Department, Kalindi College

Sl. No.	Name	Designation	Committee Name
1.	Dr. Mayanglambam Rojina Devi	Co-Convenor	Northeast and Himalayan Frontier
2.		Member	Alumni Committee
3.		Member	Remedial Classes
4.		Member	Fashion-is-ta Society

Research Supervision:

- **Principal investigator** for the In-house project titled **"Biomonitoring of Bird's Species diversity of Kalindi College Campus to assess the healthy ecosystem"**

Workshops Organised:

- Organised one day Workshop on **"Heart Health Awareness and CPR Training Workshop*" as Convenor*** on 5th November, 2024 from 11 AM in seminar room, Kalindi College.
- Organised one day Cancer Awareness Seminar on the topic ***"Preventive and Therapeutic Approaches in Cancer: A Holistic Perspective"*** as **Convenor**, on 7th November, 2024 from 11 AM in hybrid mode.
- Organised one day National Webinar **"Biological Routes to Energy Security in Viksit Bharat"** as event **Coordinator** on 27th February 2025 from 11:30 AM in Conference Room TRI-5, Kalindi College.
- Organised one day "**Health Camp**" as **Co-Convenor** in collaboration with Medical Committee, Kalindi College and Venkateshwar Hospital, Dwarka, New Delhi on 7th February 2025.
- Organised Eirene "Miss Freshers' 2024" of the Northeast and Himalayan Frontier Cell on 14th November 2024 as **Co-Convenor**.
- Organized an educational visit of Eco club "Kalpdhara" students to Sunder Nursery and attended a hands-on workshop on Beekeeping on 5th November 2024.
- Organized an educational visit of B.Sc. (H.) Zoology 1st Year students to Sunder Nursery and attended a hands-on workshop on Beekeeping as part of curriculum of the paper "Apiculture" on 17th December 2024.

Workshops Attended:

- Participated in Four-week **Faculty Induction Program** (**Gurudakshita**) organized by MMTTC, Pt. Ravishankar Shukla University, Raipur, Chhattisgarh from 27 August -30 September 2024.
- Participated in One week Faculty Development Programme on '**NEP 2020 ORIENTATION AND SENSITIZATION PROGRAMME' organized by** CPDHE and Kalindi College, University of Delhi from 08-17 October 2024.
- Participated One week Faculty Development Programme on "One week Short Term Course on "**Science Innovation and Technology in 21 Century** " organized by UGC-MMTTC, Bhagat Phool Singh Mahila Vishwavidyalaya, Sonipat, Haryana from 03-08 February 2025.
- Participated in National Webinar on **"Multiomics Approaches to Understanding Biology with Oxford Nanopore Sequencing"** organized by Dept. of Zoology, Swami Shraddhanand College, University of Delhi on 21st November, 2024.
- Participated in National Webinar on **"Developing genetic resources for red snapper, an important marine food fish"** organized by Dept. of Zoology, Swami Shraddhanand College, University of Delhi on 5st November, 2024.
- Participated in International Webinar on "HARIT: Indigenous Techniques to combat climate change" organised by Paryavaran Sanrakshan Gatividhi, ICCS, IIT Alumni WHEELS Global Foundation, ShoDH and GRC India on13th October 2024.

Dr. Neeti Pandey

1. Invited as external expert for curriculum restructuring under NEP 2020 in Kumaun University.
2. Attended Faculty Development Programme (NEP orientation and sensitization Programme) conducted by Centre for Professional and Development in Higher Education (CPDHE) and Kalindi College, University of Delhi from 8th October, 2024 to 17th October,2024 sponsored by MINISTRY OF EDUCATION, Malaviya Mission Teacher Training Programme.
3. Attended Short Term Course on Disaster Management conducted by UGC-MMTTC, University of Lucknow from 16th December,

2024 to 22nd December, 2024 sponsored by MINISTRY OF EDUCATION, Malaviya Mission Teacher Training Programme.

4. Appointed as Co-convenor for website committee, Kalindi College, University of Delhi.
5. Appointed as Co-convenor of ECA- Mehendi club 2024-2025.
6. Appointed as examiner for setting question paper of Wildlife conservation and management by Department of Zoology, University of Delhi.
7. Appointed as Convenor for setting theory question paper of Cell and Developmental Biology of Animals by Department of Zoology, University of Delhi.
8. Appointed as member of Workload committee (Science) by Kalindi College, University of Delhi
9. Appointed as member of Gandhi Study Circle by Kalindi College, University of Delhi
10. Appointed as member of Pravah Magazine (Science) by Kalindi College, University of Delhi
11. Appointed as member of AQAR committee, IQAC by Kalindi College, University of Delhi

Ms. Shikha Rani

Academic Achievement (2024-2025)

Committees

1. Zoological society-Zoonomia – Co-convener
2. Admission Committee (Zoology)- Member
3. Rangoli Committee- Member

Workshop/ Seminar Organisned

1. Organised a workshop on Foldscope Frontiers: Exploring The microscope World with Dr. Rishikesh Krishan Laxmi and Dr. Joni Yadav.
2. Organised an inaugural lecture on Sexual Health and Sexuality and Oath ceremony of Zoonomia society with Dr. Tripti Sharan.
3. Organised Seminar on Anticancer Role of Gut Microbiota Metabolites with Dr. Anil Kumar.
4. Prepared a Zoological society Magazine.
5. Organized Intra-college competition in Rangoli making.

Projects

1. In house project on role of Plant metabolites and its effect on gut microbiota.

Poster Presented

1. Presented a paper titled "role of sox9 duplicated in freshwater catfish Heteropneustes fossilis" in international conference on endocrinology, metabolism and reproduction: exploring new frontiers organized by Department of Zoology, University of Jammu, Jammu UT J&K, India on 24th October 2025.

2. Presented a poster tiltled "Butea monosperma, a potential candidate in modern medicine" in Equinox, 4th Annual International Conference organized by Maitreyi college, University of Delhi. On 4th September 2025.

Dr. Priyanka Dahiya
Assistant Professor, Department of Zoology

- **Member:** Sports Committee
- **Member:** Waste management, e-waste and write-off Committee
- **Co-convenor: NIRF** Committee
- **Convenor:** Teacher's feedback Committee

Publication (Peer Reviewed/Indexed Journals): NA

Chapters in Edited Books: NA

<u>Workshops Organised:</u>

- Organized one-day Webinar on "**Preventive and therapeutic approaches in cancer; A holistic perpective**" held in Kalindi College, University of Delhi on 07th November, 2024.
- Organized one day workshop on "**Hearth health awareness and CPR training" held in Kalindi College**, University of Delhi on 05th November, 2024.
- Organized one day seminar on "**Biological routes to energy security in viksit bharat" held in Kalindi College**, University of Delhi on 27th February, 2020.
- Organizing committee member in one day workshop on "**Foldscope frontiers: Exploring the microscopic world**" in association with Zoological society, Kalindi College, University of Delhi, Delhi, India on 04th March, 2025.
- Organizing committee member in one day seminar on ***"*****Anti-cancer role of gut-microbiota metabolites*"*** in association with Zoological society, Kalindi College, on 06th March, 2025

<u>Workshops/Conferences Attended:</u>

- Participated in three-day online Workshop on **"Model organisms in research"** organized by Zoology Department, Venkateshwara College, University of Delhi from 15th -17th January, 2025.
- Participated and presented oral presentation on **"SOCE triggers Calpain-NOSIP-NO cascade mediated HKM apoptosis in *M. fortuitum* pathogenesis" in Inter-National Conference** on "**Role of biotechnology in biological sciences: Striving for sustainable future**" organized by Department of Zoology, Miranda House College, University of Delhi, 06-08th February, 2025.
- Participated in 4 weeks online **Faculty Induction Programme** organized by UGC-Malviya mission teachers training centre (MMTTC), Bhagat Phool Singh Mahila Vishwavidyalaya, Sonipat, Haryana from 22 May- 21 June, 2025.

Dr. Varsha Singh

Academic Achievements

Committees

1. IQAC - Co-coordinator
2. Medical Committee- Convener
3. Screening Committee for CAS Promotion- Member
4. Research Project Allocation Committee- Member
5. Admission Committee- Member

Workshop/Seminar Organized

1. Organized a Heart health awareness and CPR training workshop as a Medical Committee convener, on 5th November 2024.
2. Organized a Cancer Awareness Seminar on 7th November 2024.

Projects

1. DST-SERB CRG Project on "Functional interaction between ovarian catecholamine and steroids: effect of ovarian denervation in the catfish *Heteropneustes fossilis*"
2. In house Kalindi College Project on "Development of Phage-Insensitive Mutants: Phenotypic and Genotypic Comparative Analysis"
3. In house Kalindi College Project on "Green Synthesis of ZnO Nanoparticles from Leaf Extract of *Ocimum sanctum* and their study against plant fungal pathogens"

Paper Presented

1. Presented a paper titled "Neuroendocrine relationship between Corticotropic and gonadotropic axis with respect to neuropeptides in the catfish *Heteropneustes fossilis*" in International Conference on endocrinology, metabolism and reproduction: exploring new frontiers organized by Department of Zoology University of Jammu, Jammu UT J&K, India on 24-10-2024.

Dr. Tarkeshwar

Individual Achievements, 2024-25

Paper Publication

Sharma, M., **Tarkeshwar**, Singh, A., Kumar, P., Kumar, M. and Kapinder (2024). Potential role of biomaterial-based polymers in pharmaceutical industry. *Biochem. Cell. Arch.* **24**, 13-24. DOI: https://doi.org/10.51470/bca.2024.24.1.13.

Book Chapter

Kapinder, Kumar, A., Deepika, Deepanshi, and **Tarkeshwar** (2025). Role of Nutraceutical Fruits in Gut-Related Diseases. In R. K. Kesharwani, P. Kumar, and R. K. Keservani, *The Nature of Nutraceuticals History, Properties, Sources, and Nanotechnology* (pp. 97-112). USA, Apple Academic Press, CRC. ISBN: 9781774917022 (Hard), ISBN: 9781003518969 (E-Book)

Resource person/Contribution/Organiser

1. Organized a Plantation Drive on the theme "Grow a Tree for Life," an Environmental Action Programme, as IQAC Coordinator in association with Garden Committee on 15-07-2024 at Kalindi College.
2. Organized a seminar and paper presentation competition on the topic "Real Dhan: Human Health-A Step Towards Arogyata" as IQAC coordinator in association with Department of Commerce and Garden Committee on 31-01-2025 at Kalindi College.
3. Organized an "Awareness Campaign and Mammography Screening Camp" as IQAC coordinator in association with Department of Computer Science and on 14-11-2024 in college campus.
4. Organized an invited talk on the topic "*Swatantra Bharat Me Hindi Me Kamkaj Ki Anivaryata*" *(*स्वतत्रं भारत मे हिन्दी मे कामकाज की अनिवार्यता) on 27-02-2025 as IQAC Coordinator in association with राजभाषा का्ायन्वि सममनत (*Rajbhasha Karyanvan Samiti),*
5. Organized an invited talk on "वैश्वीकरण के दौर मे हिन्दी" on 18-09-2024 under the theme *Hindi Pakhwada* (14-09-2024 to 26-09-2024), as IQAC Coordinator in association with Hindi Sahitya Parishad, Department of Hindi.
6. Organized a National Conference on "Sustainable Startups: Integrating Traditional Knowledge with Innovation", on 17-02-2025, as IQAC Coordinator in association with IBSD Committee.
7. Resource person-Project Evaluator at Zonal Maths-Science Fair (Gyan-vigyan mela), on 01-10-2024, organised by Shishu Bharti Vidyalaya, Vidya Bharti, Jhilmil, Delhi.
8. Resource person- Session Chair, for Technical Session of National Conference on *"Punyashloka Ahilyabai Holkar: Empowering Society through Values, Virtues, Compassion, and Leadership",* held from 03-04 February 2025, organized by Department of History, Kalindi College, University of Delhi.

Participation in Seminar/workshop/FDP

1. Completed 10 days Online Certificate Course-cum-Workshop on "MICROSOFT POWERPOINT USING AI TOOLS" held from 11th-20th December 2024, organized by Sanatan Dharma College, Ambala Cantt, Haryana.

2. Completed 10 days Online Certificate Course-cum-Workshop on "MICROSOFT WORD USING AI TOOLS" held from 1st - 10th January 2025, organized by Sanatan Dharma College, Ambala Cantt, Haryana.
3. Participated in International webinar on "Accelerating Equity in Science (GWB-2025)" held on 11-02-2025, organized by IQAC & Department of Chemistry, Jagat Arts, Commerce & IHP Science College, Goregaon, Maharashtra.
4. Participated in Online Training Programme on "NEP 2020 Orientation & Sensitization Programme" held from 03rd – 11th March, 2025, under MMTTP, UGC organized by Mahatma Hansraj Malaviya Mission Teacher Training Centre (MH-MMTTC), Hansraj College, University of Delhi and Kalindi College, University of Delhi.

Visited as Subject expert/Special Lecture

1. Appointed as Subject Expert & Head Examiner (Evaluation Board) for the Zoology subject at Jharkhand Public Service Commission (JPSC), Ranchi, Jharkhand.

Inhouse Research Projects

1. Title of the Project: ***"An Assessment based study of Kalindi college Students' health status using behavioural and nutraceutical components as tool"***

Member of Learned Body

- Life time member of "Society for Promotion of Education and Science (SPES)", Delhi, India
- Life Member, Himalayan Life Science Society, CUHP, Dharmshala, HP, India.
- Associate Editor 'Editorial Board' of 'Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)' and it's journal(s).
- Associate Editor of 'Editorial Board' of 'Lattice Science Publication (LSP) and it's journal(s).

Administrative Duties/Contribution to Corporate Life of College

1. **Coordinator:** Internal Quality Assurance Cell (IQAC)**,** Kalindi College
2. Public Information Officer (PIO), Kalindi College
3. **Convener:** MIS Committee
4. **Member:** Budget Estimate, Allocation and Expenditure Committee
5. **Member:** Research Fund Allocation Committee, Kalindi College
6. **Member:** Internal Complaint Committee, Kalindi College
7. **Member:** Space and Infrastructure Committee
8. **Member:** Academic Committee, Kalindi College
9. **Member:** Research Committee, Kalindi College

Tarkeshwar

Achievements 2024- 25

Dr. K Vandana Rani
Assistant Professor
Zoology Department, Kalindi College

Publication

Uma Bharati Sahu, Kumari Vandana Rani , Neeta Sehgal, 2024. Insulin-like growth factor 1 (IGF1) in the hypothalamo-pituitary-gonadal-liver (HPG-L) axis: identification, sequencing, gene expression and in silico analysis in the Indian freshwater catfish, *Heteropneustes fossilis*. **Iran. J. Ichthyol.** (2024) 11(2): 124-146

DOI: https://doi.org/10.22034/iji.v11i2.1006

Inhouse Research Projects

- **Principal investigator** for the In-house project titled " **Histopathological Insights into the Influence of Plant Bioactive Components on Fish Health"**

Conference / Workshops Organised

- As **Convenor**: two day National Conference theme" ***"Innovation, Ownership and Ethics in the Age of AI Resesrvch"***, organised by Research Committee on 15th- 16th May, 2025.
- As Convenor: One day Workshop for Students" ***Foldscope Frontiers: Exploring the Microscopic World***" organized by Zoonomia, Zoology Department in Zoology Lab on 4th March 2025.
- As Convener: Lecture on "***Vigilance Awareness***" for Teaching and Non-Teaching Staff organized by Vigilance Awareness Committee, Kalindi College, University of Delhi in Seminar Room on 25th November 2024
- As Convener: Inaugural lecture &oath ceremony on topic ***"Sexual health and Sexuality"*** organized by Zoonomia, the Zoological Society, Kalindi College, University of Delhi in Seminar Room on 18th October 2024.
- As Convener: One day Seminar on ***"Anticancer Role of Gut Microbiota Metabolites"*** organized by Zoonomia, the Zoological Society, Kalindi College, University of Delhi on 22nd April 2024.

Conference / Workshops Attended

- Actively Participated and gave an oral presentation entitled "***Unveiling the Interplay between Gonadotropic……Reproductive Health Diagnostics***" in the three day International Conference on " Recent Advances in Medical Diagnostics: from Chemicals to AI"(RAMD-2025), Convened by Bionomie from February 19-21, 2025.
- Presented a research paper entitled "Exploring the Therapeutic Potential of Cassia fistula: A Sustainable Approach to Enhancing Fish Health in Aquaculture" in International Conference ENVIRONMENT AND SOCIETY (6th ICES) Theme: Indiscriminate Anthropogenic Impact: A Trans-disciplinary Approach to Environmental and Social Sustainability jointly organized by Mahakaushal University, Jabalpur (M.P.) Sri Guru Tegh Bahadur Khalsa College, Jabalpur (M.P.) The Global University, Itanagar (Arunachal Pradesh) The American University, USA ICAR-Directorate of Weed Research (DWR), Jabalpur Glocal Environment & Social Association (GESA), New Delhi on 10th & 11th May, 2025
- Participated in the International webinar on " The Evovlving Landscape of Cells & Gene Therapy: Quest, Peril, Promise & Evertything in Between" organized by Department Of Zoology, Sawmi Shardhanand Collge, University of Delhi in Colllaboration with the Deepartment of Microbiology, Sawmi Shardhanand Collge, University of Delhi on February 26, 2025.
- Participated in the International webinar on "An Old Foe, A new Threat: Could Mycobacterium Orygis Undermine TB Control Target?" organized by Department Of Zoology, Sawmi Shardhanand Collge, University of Delhi in Colllaboration with the Deepartment of Microbiology, Sawmi Shardhanand Collge, University of Delhi on January 16, 2025"
- Participated in three day online workshop on '"Model Organism in Research" organized by Department of Zoology, Sri Venkateshwara College, university of Delhi, New Delhi, India from January 15-17, 2025
- Participated in webinar" SAMBHAV" Sustainable Advancement for Modernizing Bharat's Food Processing Vision Organized by National Institute of Food Technology Entrepreneurship and Management, Kundali (NIFTEM-K) held on 28th March 2024.

Award/ Recognition:

- Secured **Ist Position** in oral presentation Competition entitled "***Unveiling the Interplay between Gonadotropic……Reproductive Health Diagnostics"*** in the three day International Conference on " Recent Advances in Medical Diagnostics: from Chemicals to AI"(RAMD-2025), Convened by Bionomie from February 19-21, 2025.

Sl. No.	Name	Designation	Committee Name
1.	Dr. K Vandana Rani	Convenor	Research Committee
2.		Convener	Zoonomia, Zoological Society
3.		Member (@University)	Courses Committee, Zoology Department, University of Delhi
4.		Convener	Vigilance Committee

Achievements 2024- 25

Dr. Mayanglambam Rojina Devi

Assistant Professor

Zoology Department, Kalindi College

Sl. No.	Name	Designation	Committee Name
1.	Dr. Mayanglambam Rojina Devi	Co-Convenor	Northeast and Himalayan Frontier
2.		Member	Alumni Committee
3.		Member	Remedial Classes
4.		Member	Fashion-is-ta Society

Research Supervision:

- **Principal investigator** for the In-house project titled **"Biomonitoring of Bird's Species diversity of Kalindi College Campus to assess the healthy ecosystem"**

Workshops Organised:

- Organised one day Workshop on **"Heart Health Awareness and CPR Training Workshop*" as Convenor*** on 5th November, 2024 from 11 AM in seminar room, Kalindi College.
- Organised one day Cancer Awareness Seminar on the topic ***"Preventive and Therapeutic Approaches in Cancer: A Holistic Perspective"*** as **Convenor**, on 7th November, 2024 from 11 AM in hybrid mode.
- Organised one day National Webinar **"Biological Routes to Energy Security in Viksit Bharat"** as event **Coordinator** on 27th February 2025 from 11:30 AM in Conference Room TRI-5, Kalindi College.
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- Participated in National Webinar on **"Multiomics Approaches to Understanding Biology with Oxford Nanopore Sequencing"** organized by Dept. of Zoology, Swami Shraddhanand College, University of Delhi on 21st November, 2024.
- Participated in National Webinar on **"Developing genetic resources for red snapper, an important marine food fish"** organized by Dept. of Zoology, Swami Shraddhanand College, University of Delhi on 5st November, 2024.
- Participated in International Webinar on "HARIT: Indigenous Techniques to combat climate change" organised by Paryavaran Sanrakshan Gatividhi, ICCS, IIT Alumni WHEELS Global Foundation, ShoDH and GRC India on13th October 2024.

JAN 2024-TILL DATE PUBLICATIONS FROM KALINDI COLLEGE

1. Effect of Cellular Dosage of Bone Marrow Aspiration Concentrate on the Radiological Outcomes in Knee Osteoarthritis: A Phase I Dose-Escalation Study. Muthu S, Ramanathan K, Alagar Yadav S, Jha SK, Ranjan R. Indian J Orthop. 2024 Jun 22;58(8):1035-1042. doi: 10.1007/s43465-024-01201-8. eCollection 2024 Aug. PMID: 39087044

2. Increased Cellular Dosage of Bone Marrow Aspiration Concentrate Does Not Translate to Increased Clinical Effectiveness in Knee Osteoarthritis: A Phase I Dose Escalation Study.

   Muthu S, Ramanathan K, Alagar Yadav S, Jha SK, Ranjan R.Indian J Orthop. 2024 Jun ;58(8):1001- 1008. doi: 10.1007/s43465-024-01197-1. eCollection 2024 Aug.PMID: 39087042
3. Bone Marrow Aspirate Concentrate for Treatment of Primary Knee Osteoarthritis: A Prospective, Single-Center, Non-randomized Study with 2-Year Follow-Up. Jeyaraman M, Jeyaraman N, Ramasubramanian S, Ranjan R, Jha SK, Gupta A.Indian J Orthop. 2024 May 9;58(7):894-904. doi: 10.1007/s43465-024-01168-6. eCollection 2024 Jul. PMID: 38948370

4. Efficacy of stromal vascular fraction for knee osteoarthritis: A prospective, single-centre, non-randomized study with 2 years follow-up.Jeyaraman M, Jeyaraman N, Jayakumar T, Ramasubramanian S, Ranjan R, Jha SK, Gupta A.World J Orthop. 2024 May 18;15(5):457-468. doi: 10.5312/wjo.v15.i5.457. eCollection 2024 May 18.PMID: 38835682 Free PMC article.

5. Nrf2/Keap1/ARE regulation by plant secondary metabolites: a new horizon in brain tumor management.Dewanjee S, Bhattacharya H, Bhattacharyya C, Chakraborty P, Fleishman J, Alexiou A, Papadakis M, Jha SK.Cell Commun Signal. 2024 Oct 15;22(1):497. doi: 10.1186/s12964-024-01878-2.PMID: 39407193 Free PMC article. Review.

6. Investigating the Potential Therapeutic Mechanisms of Puerarin in Neurological Diseases.
Chauhan P, Wadhwa K, Mishra R, Gupta S, Ahmad F, Kamal M, Iqbal D, Alsaweed M, Nuli MV, Abomughaid MM, Almutary AG, Mishra PC, Jha SK, Ojha S, Nelson VK, Dargar A, Singh G, Jha NK. Mol Neurobiol. 2024 Dec;61(12):10747-10769. doi: 10.1007/s12035-024-04222-4. Epub 2024 May 23.PMID: 38780722 Review.

7. Unveiling the impact of aging on BBB and Alzheimer's disease: Factors and therapeutic implications.Kumar Nelson V, Jha NK, Nuli MV, Gupta S, Kanna S, Gahtani RM, Hani U, Singh AK, Abomughaid MM, Abomughayedh AM, Almutary AG, Iqbal D, Al Othaim A, Begum SS, Ahmad F, Mishra PC, Jha SK, Ojha S.Ageing Res Rev. 2024 Jul;98:102224. doi: 10.1016/j.arr.2024.102224. Epub 2024 Feb 10.PMID: 38346505 Review.

8. Psychedelics for alzheimer's disease-related dementia: Unveiling therapeutic possibilities and pathways.Sinha JK, Trisal A, Ghosh S, Gupta S, Singh KK, Han SS, Mahapatra M, Abomughaid MM, Abomughayedh AM, Almutary AG, Iqbal D, Bhaskar R, Mishra PC, Jha SK, Jha NK, Singh AK.Ageing Res Rev. 2024

Apr;96:102211. doi: 10.1016/j.arr.2024.102211. Epub 2024 Feb 1.PMID: 38307424 Review.

9. Cannabidiol and neurodegeneration: From molecular mechanisms to clinical benefits.Jha SK, Nelson VK, Suryadevara PR, Panda SP, Pullaiah CP, Nuli MV, Kamal M, Imran M, Ausali S, Abomughaid MM, Srivastava R, Deka R, Pritam P, Gupta N, Shyam H, Singh IK, Pandey BW, Dewanjee S, Jha NK, Jafari SM. Ageing Res Rev. 2024 Sep;100:102386. doi: 10.1016/j.arr.2024.102386. Epub 2024 Jul 4.

Effect of Cellular Dosage of Bone Marrow Aspiration Concentrate on the Radiological Outcomes in Knee Osteoarthritis: A Phase I Dose-Escalation Study

Original Article Published: 22 June 2024

Volume 58, pages 1035–1042, (2024) Cite this article

Indian Journal of Orthopaedics

Aims and scope

Submit manuscript

Sathish Muthu, Karthikraja Ramanathan, Sangilimuthu Alagar Yadav, Saurabh Kumar Jha & Rajni Ranjan

Abstract

Introduction

Knee osteoarthritis(KOA), a chronic degenerative disease, significantly impairs quality of life due to pain and mobility limitations. Traditional treatments focus on symptom management without addressing the underlying disease progression, leading to a growing interest in regenerative medicine approaches. Bone marrow aspirate concentrate (BMAC), rich in mesenchymal stem cells and growth factors, has shown potential for cartilage repair and symptom relief in KOA. Despite promising outcomes, the optimal

Increased Cellular Dosage of Bone Marrow Aspiration Concentrate Does Not Translate to Increased Clinical Effectiveness in Knee Osteoarthritis: A Phase I Dose Escalation Study

Original Article Published: 05 June 2024

Volume 58, pages 1001–1008, (2024) Cite this article

Sathish Muthu, Karthikraja Ramanathan, Sangilimuthu Alagar Yadav, Saurabh Kumar Jha & Rajni Ranjan

Abstract

Introduction

Knee osteoarthritis (KOA), a chronic degenerative disease, significantly impairs quality of life due to pain and mobility limitations. Traditional treatments focus on symptom management without addressing the underlying disease progression, leading to a growing interest in regenerative medicine approaches. Bone marrow aspirate concentrate (BMAC), rich in mesenchymal stem cells and growth factors, has shown potential for cartilage repair and symptom relief in KOA. Despite promising outcomes, the optimal

Indian J Orthop. 2024 May 9;58(7):894-904. doi: 10.1007/s43465-024-01168-6. eCollection 2024 Jul.

Bone Marrow Aspirate Concentrate for Treatment of Primary Knee Osteoarthritis: A Prospective, Single-Center, Non-randomized Study with 2-Year Follow-Up

Madhan Jeyaraman [1 2 3 4], Naveen Jeyaraman [1], Swaminathan Ramasubramanian [5], Rajni Ranjan [6], Saurabh Kumar Jha [2 7], Ashim Gupta [4 8 9 10]

Affiliations

PMID: 38948370 PMCID: PMC11208343 (available on 2025-05-09)
DOI: 10.1007/s43465-024-01168-6

Abstract

Introduction: Knee osteoarthritis (OA) is a widespread, disabling condition with no intervention to fully restore cartilage or halt progression. Bone marrow aspirate concentrate (BMAC), an autologous product from bone marrow aspiration, has shown promise as a regenerative therapy due to its cell composition and chondrogenic effects. Our study aims to assess the functional outcomes, including pain, function, satisfaction, and complications post-BMAC injection in knee OA patients.

Materials and methods: In this prospective, single-center study, 63 patients with grade II-III knee OA (Kellgren-Lawrence (K-L) scale) unresponsive to conservative management underwent BMAC injection. The procedure involved bone marrow aspiration from the anterior iliac crest, processing to obtain a concentrate, followed by intra-articular injection. Patients were followed for 24 months, assessing outcomes using the Visual Analog Scale (VAS), International Knee Documentation Committee (IKDC) score, and MOCART 2.0 score.

Results: The cohort, with a slight female predominance and predominantly aged 41-50 years, majorly comprised K-L grade III OA patients. BMAC treatment resulted in significant improvements in VAS pain scores, IKDC functional scores, and MOCART 2.0 scores over the 24-month follow-up.

Conclusion: BMAC injection provides significant improvement in both pain and functional outcomes at mid-term follow-up in patients with mild-to-moderate OA of the knee. Further high-quality, adequately powered, multi-center, prospective, double-blinded, randomized controlled trials with longer follow-up are necessary to justify the routine clinical use of BMAC for treatment of patients suffering with knee OA.

Keywords: BMAC; Bone marrow aspirate; Bone marrow aspirate concentrate; Knee; Knee osteoarthritis; Regenerative medicine.

Related information

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ORIGINAL ARTICLE

Prospective Study

Efficacy of stromal vascular fraction for knee osteoarthritis: A prospective, single-centre, non-randomized study with 2 years follow-up

Madhan Jeyaraman, Naveen Jeyaraman, Tarun Jayakumar, Swaminathan Ramasubramanian, Rajni Ranjan, Saurabh Kumar Jha, Ashim Gupta

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Cell Communication and Signaling

REVIEW

Open Access

Nrf2/Keap1/ARE regulation by plant secondary metabolites: a new horizon in brain tumor management

Saikat Dewanjee[1*], Hiranmoy Bhattacharya[1], Chiranjib Bhattacharyya[1], Pratik Chakraborty[1], Joshua Fleishman[2], Athanasios Alexiou[3,4,5,6], Marios Papadakis[7*] and Saurabh Kumar Jha[8*]

Abstract

Brain cancer is regarded as one of the most life-threatening forms of cancer worldwide. Oxidative stress acts to derange normal brain homeostasis, thus is involved in carcinogenesis in brain. The Nrf2/Keap1/ARE pathway is an important signaling cascade responsible for the maintenance of redox homeostasis, and regulation of anti-inflammatory and anticancer activities by multiple downstream pathways. Interestingly, Nrf2 plays a somewhat, contradictory role in cancers, including brain cancer. Nrf2 has traditionally been regarded as a tumor suppressor since its cytoprotective functions are considered to be the principle cellular defense mechanism against exogenous and endogenous insults, such as xenobiotics and oxidative stress. However, hyperactivation of the Nrf2 pathway supports the survival of normal as well as malignant cells, protecting them against oxidative stress, and therapeutic agents. Plants possess a pool of secondary metabolites with potential chemotherapeutic/chemopreventive actions. Modulation of Nrf2/ARE and downstream activities in a Keap1-dependant manner, with the aid of plant-derived secondary metabolites exhibits promise in the management of brain tumors. Current article highlights the effects of Nrf2/Keap1/ARE cascade on brain tumors, and the potential role of secondary metabolites regarding the management of the same.

Keywords Antioxidants, ARE, Brain cancer, Keap1, Nrf2, Oxidative stress, Secondary metabolites

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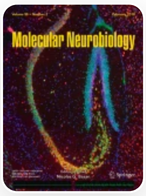
Investigating the Potential Therapeutic Mechanisms of Puerarin in Neurological Diseases

Reviews Published: 23 May 2024

Volume 61, pages 10747–10769, (2024) Cite this article



Molecular Neurobiology

Aims and scope

Submit manuscript

Payal Chauhan, Karan Wadhwa, Richa Mishra, Saurabh Gupta, Fuzail Ahmad, Mehnaz Kamal, Danish Iqbal, Mohammed Alsaweed, Mohana Vamsi Nuli, Mosleh Mohammad Abomughaid, Abdulmajeed G. Almutary, Prabhu Chandra Mishra, Saurabh Kumar Jha, Shreesh Ojha, Vinod Kumar Nelson, Abha Dargar, Govind Singh & Niraj Kumar Jha

Abstract

Plants and their derived phytochemicals have a long history of treating a wide range of illnesses for several decades. They are believed to be the origin of a diverse array of medicinal compounds. One of the compounds found in kudzu root is puerarin, a isoflavone glycoside commonly used as an alternative medicine to treat various diseases. From a biological perspective, puerarin can be described as a white needle crystal with the chemical name of 7-hydroxy-3-(4-hydroxyphenyl)-1-benzopyran-4-one-8-D-glucopyranoside. Besides, puerarin is sparingly soluble in water and produces no color or

ScienceDirect

Ageing Research Reviews
Volume 98, July 2024, 102224

Review Article

Unveiling the impact of aging on BBB and Alzheimer's disease: Factors and therapeutic implications

Vinod Kumar Nelson [a 1], Niraj Kumar Jha [b c d e 1 2], Mohana Vamsi Nuli [a], Saurabh Gupta [f], Sandeep Kanna [g], Reem M. Gahtani [h], Umme Hani [i], Arun Kumar Singh [j], Mosleh Mohammad Abomughaid [k], Ali M. Abomughayedh [l], Abdulmajeed G. Almutary [m], Danish Iqbal [n], Ayoub Al Othaim [o], S. Sabarunisha Begum [p], Fuzail Ahmad [q], Prabhu Chandra Mishra [r], Saurabh Kumar Jha [s], Shreesh Ojha [t]

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https://doi.org/10.1016/j.arr.2024.102224
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Highlights

- Aging plays a crucial role in Alzheimer’s disease progression.
- Aging mainly alters the most essential components of BBB and challenges the BBB integrity.
- Loss of BBB integrity or damage to the BBB compromises its function and allows various neurotoxins including inflammatory mediators to enter the brain.
- Identifying compounds that delay aging can prevent BBB damage and protect from the disease through preventing inflammation.

ScienceDirect

Ageing Research Reviews

Volume 96, April 2024, 102211

Review Article

Psychedelics for alzheimer's disease-related dementia: Unveiling therapeutic possibilities and pathways

Jitendra Kumar Sinha [a,1], Anchal Trisal [b,1], Shampa Ghosh [a], Saurabh Gupta [c], Krishna Kumar Singh [d], Sung Soo Han [e,f], Madhumita Mahapatra [g], Mosleh Mohammad Abomughaid [h], Ali M. Abomughayedh [i], Abdulmajeed G. Almutary [j], Danish Iqbal [k], Rakesh Bhaskar [e,f], Prabhu Chandra Mishra [m], Saurabh Kumar Jha [n], Niraj Kumar Jha [o,p,q,r,2], Abhishek Kumar Singh [l]

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Highlights

- Psychedelics have traditionally been used for spiritual and recreational purposes.
- Psychedelics have ability to enhance neural plasticity through the activation of the serotoninergic and glutamatergic systems.
- Psychedelics such as N,N-dimethyltryptamine (DMT), lysergic acid diethylamide (LSD), and Psilocybin have shown potential in mitigating the effects of this debilitating disease.
- The controlled and dose-dependent administration of psychedelics represents a novel therapeutic intervention worth exploring and

Ageing Research Reviews
Volume 100, September 2024, 102386

Review article

Cannabidiol and neurodegeneration: From molecular mechanisms to clinical benefits

Saurabh Kumar Jha [a,1], Vinod Kumar Nelson [b,1], Punna Rao Suryadevara [c], Siva Prasad Panda [d], Chitikela P. Pullaiah [e], Mohana Vamsi Nuli [f], Mehnaz Kamal [g], Mohd Imran [h], Saijyothi Ausali [i], Mosleh Mohammad Abomughaid [j], Rashi Srivastava [k], Rahul Deka [l], Pingal Pritam [l], Neha Gupta [m], Harishankar Shyam [l], Indrakant K. Singh [n], Bindhy Wasini Pandey [o], Saikat Dewanjee [p], Niraj Kumar Jha [q,r,s,1,2], Seid Mahdi Jafari [t,u]

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Highlights

- Protein aggregations are the pathological hallmark of neurodegenerative and neurological diseases.
- Accumulated protein aggregates trigger the inflammatory response and induce oxidative stress in the brain parts.
- CBD rescue from NDs by abrogating inflammation and oxidative stress by regulating multiple signalling pathways.
- CBD shows clinical benefits against various neurological and neurodegenerative diseases.

Ms. Shikha Rani

Academic Achievement (2024-2025)

Committees

1. Zoological society-Zoonomia – Co-convener
2. Admission Committee (Zoology)- Member
3. Rangoli Committee- Member

Workshop/ Seminar Organisned

1. Organised a workshop on Foldscope Frontiers: Exploring The microscope World with Dr. Rishikesh Krishan Laxmi and Dr. Joni Yadav.
2. Organised an inaugural lecture on Sexual Health and Sexuality and Oath ceremony of Zoonomia society with Dr. Tripti Sharan.
3. Organised Seminar on Anticancer Role of Gut Microbiota Metabolites with Dr. Anil Kumar.
4. Prepared a Zoological society Magazine.
5. Organised Intra-college competition in Rangoli making.

Projects

1. In house project on role of Plant metabolites and its effect on gut microbiota.

Poster Presented

1. Presented a paper titled "role of sox9 duplicated in freshwater catfish *Heteropneustes fossilis*" in international conference on endocrinology, metabolism and reproduction: exploring new frontiers organized by Department of Zoology, University of Jammu, Jammu UT J&K, India on 24th October 2024.
2. Presented a poster tiltled "Butea monosperma, a potential candidate in modern medicine" in Equinox, 4th Annual International Conference organized by Maitreyi college, University of Delhi. On 4th September 2024.

<u>Achievements 2024- 2025</u>

Dr. Priyanka Dahiya

Assistant Professor, Department of Zoology

- **Member:** Sports Committee
- **Member:** Waste management, e-waste and write-off Committee
- **Co-convenor: NIRF** Committee
- **Convenor:** Teacher's feedback Committee

Publication (Peer Reviewed/Indexed Journals): NA

Chapters in Edited Books: NA

<u>Workshops Organised:</u>

- Organized one-day Webinar on "**Preventive and therapeutic approaches in cancer; A holistic perpective**" held in Kalindi College, University of Delhi on 07th November, 2024.
- Organized one day workshop on "**Hearth health awareness and CPR training" held in Kalindi College**, University of Delhi on 05th November, 2024.
- Organized one day seminar on "**Biological routes to energy security in viksit bharat" held in Kalindi College**, University of Delhi on 27th February, 2020.
- Organizing committee member in one day workshop on "**Foldscope frontiers: Exploring the microscopic world**" in association with Zoological society, Kalindi College, University of Delhi, Delhi, India on 04th March, 2025.
- Organizing committee member in one day seminar on **"Anti-cancer role of gut-microbiota metabolites"** in association with Zoological society, Kalindi College, on 06th March, 2025

<u>Workshops/Conferences Attended:</u>

- Participated in three-day online Workshop on **"Model organisms in research"** organized by Zoology Department, Venkateshwara College, University of Delhi from 15th -17th January, 2025.
- Participated and presented oral presentation on **"SOCE triggers Calpain-NOSIP-NO cascade mediated HKM apoptosis in *M. fortuitum* pathogenesis" in Inter-National**

Conference on "**Role of biotechnology in biological sciences: Striving for sustainable future**" organized by Department of Zoology, Miranda House College, University of Delhi, 06-08th February, 2025.

- Participated in 4 weeks online **Faculty Induction Programme** organized by UGC-Malviya mission teachers training centre (MMTTC), Bhagat Phool Singh Mahila Vishwavidyalaya, Sonipat, Haryana from 22 May- 21 June, 2025.

Dr. Neeti Pandey

Faculty achievements 2024-2025

1. Invited as external expert for curriculum restructuring under NEP 2020 in Kumaun University.
2. Attended Faculty Development Programme (NEP orientation and sensitization Programme) conducted by Centre for Professional and Development in Higher Education (CPDHE) and Kalindi College, University of Delhi from 8th October, 2024 to 17th October,2024 sponsored by MINISTRY OF EDUCATION, Malaviya Mission Teacher Training Programme.
3. Attended Short Term Course on Disaster Management conducted by UGC-MMTTC, University of Lucknow from 16th December, 2024 to 22nd December, 2024 sponsored by MINISTRY OF EDUCATION, Malaviya Mission Teacher Training Programme.
4. Appointed as Co-convenor for website committee, Kalindi College, University of Delhi.
5. Appointed as Co-convenor of ECA- Mehendi club 2024-2025.
6. Appointed as examiner for setting question paper of Wildlife conservation and management by Department of Zoology, University of Delhi.
7. Appointed as Convenor for setting theory question paper of Cell and Developmental Biology of Animals by Department of Zoology, University of Delhi.
8. Appointed as member of Workload committee (Science) by Kalindi College, University of Delhi
9. Appointed as member of Gandhi Study Circle by Kalindi College, University of Delhi
10. Appointed as member of Pravah Magazine (Science) by Kalindi College, University of Delhi
11. Appointed as member of AQAR committee, IQAC by Kalindi College, University of Delhi