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REVIEW ARTICLE

ITK-Based Organic Formulations in Crop Production and Protection for Sustainable Agriculture: A Review

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ABSTRACT

Indigenous technical knowledge (ITK) has been crucial in agriculture for many generations as farmers have gained this knowledge through their experiences and observations. Recently, there has been an increasing interest in using ITK-based organic formulations for crop production, which are made from locally available organic materials and have proven to be effective in promoting plant growth and controlling pests and diseases. This paper seeks to provide a comprehensive overview of the present understanding of ITK-based organic formulations in crop production, including various types, compositions, and applications. It also examines the benefits and challenges of using ITK-based organic formulations while providing suggestions for further research in this area.

Key words: Beejamrita, Dashparni ark, indigenous technical knowledge, Jeevamrut, Panchagavya

INTRODUCTION

Indigenous technical knowledge (ITK) as "the sum total knowledge and practices which are based on people's accumulated experiences in dealing with situations and problems in various aspects of life and such knowledge and practices are special to a particular culture." ITK is the local knowledge – knowledge that is unique to a given culture or society. The special features of ITK are (World Bank, 1998) as follows. It is "local," as it is rooted in a particular community and situated within broader cultural traditions; it is a set of experiences generated by people living in those communities. Therefore, separating the technical from the non-technical, the rational from the non-rational could be problematic. When transferred to other places, there is a potential risk of dislocating ITK. It is tacit knowledge and, therefore, not easily modifiable. Codifying it may lead to the loss of some of its properties. It is transmitted orally, or through imitation and demonstration. It is experiential rather than theoretical knowledge. Experience and trial and error, tested in the rigorous laboratory of survival of local communities, constantly reinforce indigenous knowledge. It is learned through repetition, which is a defining characteristic of tradition, even when new knowledge is added. Repetition aids are the retention and reinforcement of ITK. Constantly changing, being produced as well as reproduced, discovered as well as lost, through it is often perceived by external observers as being somewhat static.

Chemical farming is a common practice among farmers in our nation. This method involves the utilization of chemical fertilizers and pesticides to cultivate crops. Due to the rising population and food demand, farmers were left with no choice but to adopt this approach to enhance crop yield. Nevertheless, chemical farming has adverse impacts,

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such as soil degradation, biodiversity reduction, and heightened greenhouse gas emissions. Overuse of synthetic fertilizers and pesticides results in significant nutrient exhaustion in the soil, leading to decreased productivity of land over time. These chemicals also lead to water pollution as they leach into nearby rivers or groundwater systems through runoff during rainfall events. Chemical farming practices may increase crop yields initially, but fail to account for the long-term effects that can harm not only the environment but also human health. Overreliance on chemical inputs contributes significantly to climate change-induced events, such as droughts or floods that further degrade soils' fertility levels (Thorat and More, 2022). The rise in health consciousness amongst the populace in recent times has led to a surge of interest towards sustainability within the Indian agricultural sector. Organic farming has gained popularity, with consumers increasingly demanding sustainably produced food. However, organic farmers face significant challenges when it comes to crop protection against pests and diseases. In response to this need, ITK-based organic formulations have emerged as an effective way of promoting sustainable agriculture. ITK stands for indigenous traditional knowledge, which refers to knowledge gained over generations by indigenous communities through observation and experimentation. The use of ITK-based organic foliar formulations in crop production has shown great potential in improving plant health and productivity while reducing reliance on conventional chemical fertilizers that can harm both human health and the environment (Priya *et al.,* 2019; Biswas and Das, 2022). This approach represents a significant departure from traditional farming methods that rely heavily on synthetic inputs, such as pesticides and chemical fertilizers. By adopting this innovative method, farmers can reduce their environmental footprint while also creating healthier crops with higher yields.

COMPOSITION OF ITK-BASED ORGANIC FORMULATIONS

The ingredients used in ITK-based organic formulations differ based on the particular formulation and the accessibility of materials in that area. While some formulations maintain the basic ingredients, farmers may also add other materials. For instance, panchagavya uses cow dung, cow urine, curd, milk, and ghee as main ingredients; however, Tamil Nadu farmers tend to include coconut water and bananas to their mixture. Similarly, farmers from Maharashtra and Uttar Pradesh add jaggery and herbal extracts, such as neem, amla, and brahmi to their formulations (Gawade *et al.,* 2007).

EFFECT OF ORGANIC FORMULATIONS ON GROWTH AND YIELD: PANCHAGAVYA

Panchagavya, an ancient Indian preparation made from cow urine, dung, milk, curd, and ghee, is one such remedy that has attracted attention as an effective organic fertilizer. The use of panchagavya as a natural plant growth enhancer dates back to Vedic times when farmers used it extensively to improve soil health and boost crop productivity. This unique mix contains essential nutrients, such as nitrogen (N), phosphorus (P), potassium (K), sulfur (S), magnesium (Mg), and calcium (Ca), along with various micronutrients. The application of Panchagavya has been shown to have a positive impact on crop growth and yield through its various nutrient contributions and soil conditioning properties. A study conducted by (Kumar and Singh, 2020) discovered that panchagavya can boost productivity by promoting the growth of roots, stems, branches, and leaves. The researchers also observed an improvement in various associated and other quality parameters, which ultimately led to better overall yield characteristics. In their study (Shekh *et al.,* 2018) found that using 5 tons/hectare of farmyard manure resulted in increased yields of both pods and haulms. In addition, a foliar spray containing 3% panchagavya was also effective in increasing yields for summer groundnut. According to (Swarnam *et al.,* 2016) findings, the foliar application of 3% Panchagavya resulted in an overall increase in plant height and number of branches across all stages of plant growth. In addition, a considerable rise was observed in the average fruit yield, with an output of 824.7 g/plant compared to the control group's yield of 330.1 g/plant. As per the study carried out by (Sudhakar *et al.,* 2011), the application of panchagavya through foliar spraying has been found to have a noteworthy effect on

maize crop productivity. The highest yield of maize was achieved when the full recommended dose of fertilizers (RDF) was applied and three sprays of 3% Panchagavya were administered at different stages of the crop's growth (20, 40, and 60 days after sowing). In a field experiment conducted by Rakesh *et al.* (2017), the impact of Panchagavya on the growth and yield of Abelmoschus esculentus cv. Arka Anamika was investigated. The outcomes revealed that the application of Panchagavya positively impacted crop growth and yield through its various nutrient contributions and soil conditioning properties. Specifically citing how it remedied modern chemical agriculture issues due to being an organic farming remedy for curing ills associated with modern chemical agriculture. Patel *et al.,* (2013) supported these findings by concluding that panchagavya had a significant influence on plant height, along with stem girth diameter increases along improved vegetative traits, such as increased leaf area index, leading to more effective photosynthetic activity, where there was higher oil-content production consequently resulting in better yields.

JEEVAMRUT

Jeevamrut is an organic solution made from cow dung and urine, along with other ingredients, such as jaggery and gram flour. It is prepared by mixing these ingredients together and allowing them to ferment for several days. The solution that is produced consists of advantageous microorganisms, such as nitrogen-fixing and P-solubilizing bacteria, fungi, and protozoa. These microorganisms play a crucial role in enhancing soil health by decomposing organic matter into nutrients, which can be assimilated easily by plants. Jeevamrut has an acidic property with a pH value of 4.93 and serves as an excellent source of both macro and micro nutrients, including N (1.97%), P (0.172%), K (0.29%), Mn (47 ppm), and Cu (50 ppm). (Kumar *et al.,* 2021). The application of Jeevamrut has demonstrated remarkable advantages in enhancing the development and production of crops. According to Rathore *et al.* (2023) the use of fermented liquid organic nutrient formulations, such as jeevamrut, can significantly contribute to the soil dehydrogenase enzyme activity, phosphatase enzyme activity, and urease enzyme activity (25.5 moles PNP h^{-1} g^{-1} soil) leading to higher yields and soil longevity in crops, such a brinjal. A study was performed by Patel *et al.* (2021), which demonstrated that the utilization of jeevamrut at a quantity of 500 L/ha in conjunction with irrigation at 30 and 45 days after sowing resulted in noteworthy enhancements to both growth indicators and yield attributes for summer pearl millet. The grain yield increased up to 4393 kg/ha while the straw yield was recorded as high as 7567 kg/ha. Moreover, Somdutt *et al.* (n.d) revealed that the use of jeevamrut can enhance plant growth and yield by improving soil health, thereby increasing nutrient availability in crops. This suggests that utilizing this organic fertilizer could be an effective way to boost crop yields without resorting to harmful chemicals. Furthermore, Dhomne *et al.,* (2021), conducted a field experiment with pigeonpea where they applied jeevamrut through soil application at different stages of growth. The researchers discovered that the utilization of soil application at a rate of 500 L/hectare, in addition to plant growth regulators, led to notable enhancements in various growth parameters, such as plant height, leaf area per plant, total dry matter production per plant, and yield/yield attributes. The results indicate that there is considerable potential for using jeevamrut as an alternative option over chemical fertilizers since it offers multiple benefits, such as enhancing soil health and providing nutrients needed for optimal crop development.

BEEJAMRITA

The use of Beejamrita has been significant for farmers since ancient times as one of their traditional methods. This organic mixture, which consists of cow dung, cow urine, water, lime, and soil, helps promote plant growth while also providing protection against harmful pathogens from the soil and seeds. Beejamrita is prepared using cow dung (5 kg) that is wrapped in cloth and soaked overnight in a bucket filled with 50 L of water. The following day, the dung in the cloth is squeezed and dipped repeatedly in the water. In addition, 5 L of cow urine, a small amount of soil, and 50 g of calcium chloride are included in this solution. Several studies have investigated the effects of Beejamrita

on crop yield and growth. Beejamrita solution contains various advantageous microorganisms, including nitrogen-fixing bacteria, phosphorus-solubilizing agents, actinomycetes, and fungi (Devakumar *et al.,* 2014). Dhomne *et al.* (2021) found that Beejamrita can increase the nutrient availability in soil by promoting microbial activity. This increased microbial activity leads to improved nitrogen fixation and phosphate solubilization, which ultimately enhances plant growth. Similarly, Nirmale and Ulape (2020) found that "Beejamrita" contains beneficial microorganisms that enhance nitrogen fixing capabilities while also protecting plants from harmful pathogens present in both soil and seeds. In addition, it was demonstrated in this research that the application of Beejamrita enhances the accessibility of vital nutrients within the soil, resulting in a notable enhancement in crop yield. Shyamsunder and Menon (2021) further supported these findings by showing how Beejamrita improves soil health through enhancing microbiological activities, leading to better nutrient cycling, resulting in enhanced plant growth capacity.

STRATEGIES FOR INTEGRATION OF ITKs INTO SCIENTIFIC RESEARCH PROCESS

Today, it is widely accepted among agricultural scientists throughout the world that the reassessment of ITK is an indispensable part of the introduction of new agricultural technology. It is recognized that the knowledge of farmers must be taken into account before any new technology is developed and disseminated. This view is based on the assumption that farmers have a wealth of knowledge pertaining to their own environment; farmers have developed specific skills designed to make the best use of that environment. The four important steps in the inclusion of the ITKs in the technology generation, reassessment, and adaptation process are documentation, validation, refinement, and integration.

DASHPARNI ARK

Dashparni Ark is a natural, organic pest repellent and plant tonic derived from fermented extracts of ten medicinal leaves. It is used to boost plant immunity, improve growth, and protect against pests in home gardens, farms, and nurseries. It can be applied as a foliage spray after diluting it with water. Dashparni Ark is a traditional, organic solution made from fermented extracts of ten medicinal leaves, known for their pest-repellent and growth-enhancing properties. It acts as both a plant tonic and a natural pesticide, boosting plant immunity and deterring pests. It's typically diluted in water and applied as a foliage spray on leaves. It's a chemical-free and organic solution for pest control, promoting healthy plant growth (Kasarkar *et al.,* 2021)

In most of the states, leaves of Neem (*Azadirachta indica*), Nirgudi (*Vitex negundo*), Karanj (*Pongamia pinnata*), Supla (*Mundulea sericea*), Tun (*Toona ciliate*), Teak (*Tectona grandis*), Young leaves of Komal (*Koelzell apadularia*), Bhang (*Cannabis sativa*), and MethoDodi (*Leptadenia reticulate*) have been used. In addition, wood ash of some plants, such as Babhul (*Acacia nilotica*), Suru (*Casurina equisitifolia*), Mango (*Mangifera indica*), and Tamarind (*Tamarindus indica*), used. Some places powdered rhizome of sweet flag (*Acorus calamus*) or turmeric (*Curcuma longa*) is used to protect crops from pest attack (Kulkarni and Kumbhojkar, 1996). The Mahadeo Koli tribe from Maharashtra uses leaves of Kulith (*Dolichos uniflorus*) and Sag (*Tectona grandis*) as preservatives for seed storage (Kulkarni and Kumbhojkar, 2003). In Tamil Nadu, paddy and sorghum grains are stored along with Ipomoea fistulosa, which prevents pest attack. Major store grain pests are rice moth, red flour beetle, pulse beetle, and rice weevil, are controlled effectively with tribal pesticides. The effective treatment included during with salt powder, kitchen ash, vitex leaves powder, cow dung ash, turmeric powder, and a mixture of neem leaves, vitex leaves, and turmeric powder.

CONCLUSION

ITK-based organic formulations have the ability to significantly contribute to sustainable crop production by lessening the environmental effects of crop production and encouraging sustainable agricultural techniques. Nevertheless, additional investigation is required to substantiate their

usefulness and safety, and to determine the most efficient formulations for particular crops and pests, or diseases. It is also necessary to standardize the creation and implementation of these formulations to guarantee their effectiveness. In general, organic formulations based on ITK offer a hopeful strategy for managing pests and diseases in crops while promoting sustainable agricultural practices.

REFERENCES

1. Biswas S, Das R. Use of amritpani: An excellent bio-enhancer for sustainable agriculture: An overview. Agric Rev 2022;1:136-9.
2. Devakumar N, Shubha S, Gowder SB, Rao GG. Microbial analytical studies of traditional organic preparations beejamrutha and jeevamrutha. Build Org Bridge 2014;2:639-42.
3. Devapatni MK, Prashar J, Singh M, Menon S, Singh G. ITK based organic formulations in crop production: A review. Ecol Environ Conserv 2023;29:S124-9.
4. Dhomne MB, Durge DV, Sonkamble PA, Rathod TH. Influence of plant growth regulators and jeevamrut on morphological and yield parameters of pigeonpea (*Cajanus cajan* L.). Int J Curr Microbiol Appl Sci 2021;10:72-9.
5. Gawade DR, Sable SS, Nikam SB. Studies on panchagavya: A potential organic input for sustainable agriculture. Agric Sci Dig 2007;27:27-31.
6. Sarma PK, Baruah J, Kalita J. Information Bulletin Indigenous Technical Knowledge All India Coordinated Research Project for Dryland Agriculture Biswanath Chariali Centre Biswanath College of Agriculture. Sonitpur, Assam: AAU Biswanath Chariali; AAU/DR/14(BU)/73/2021-22-1 .
7. Kasarkar AR, Kulkarni DK, Salokhe SP. Phytochemicals investigated in dashparni ark. Int J Agric Plant Sci 2021;3:48-51.
8. Kulkarni DK, Kumbhojkar MS. Ethno-agricultrual study of Mahadeokolis in Maharashtra, India. Asian Agri History 2003;7:295-312.
9. Kumar A, Avasthe RK, Babu S, Singh R, Verma G, Gudade BA, *et al*. Jeevamrut: A low cost organic liquid manure in organic farming for sustainable crop production. Kerala Karshakan E J 2021;9:32-4.
10. Kumar CS, Singh G. Effect of panchagavya on growth and yield: A review. Int J Curr Microbiol Appl Sci 2020;9:617-24.
11. Nirmale ST, Ulape MD. Beejamrutha: The agricultural bioenhancer. Int J Sci Res Dev 2020;8:586.
12. Patel R, Rawat GS, Dhakad R. Effect of foliar application of nutrients on growth and yield of cowpea [*Vigna unguiculata* (L.) Walp]. Bhartiya Krishi Anusandhan Patrika 2019;34:74-6.
13. Priya RV, Ravi G, Elanchezhyan K. ITK adoption pattern of organic farming in Tamil Nadu for the management of shoot and fruit borer, *Leucinodes orbonalis* Guenee in brinjal crop. J Agric Ecol 2019;8:59-69.
14. Rathore G, Kaushal R, Sharma V, Sharma G, Chaudhary S, Dhaliwal SS, *et al*. Evaluation of the usefulness of fermented liquid organic formulations and manures for improving the soil fertility and productivity of brinjal (*Solanum melongena* L.). Agriculture 2023;13:417.
15. Roy S, Rathod A, Sarkar S, Roy K. Use of ITK in plant protection. Pop Kheti 2015;3:75-8.
16. Shekh MA, Mathukia RK, Sagarka BK, Chhodavadia SK. Evaluation of some cow-based bio-enhancers and botanicals for organic cultivation of summer groundnut. Int J Econ Plants 2018;5:43-5.
17. Shyamsunder B, Menon DS. Study of traditional organic preparation beejamrita for seed treatment. Int J Modern Agric 2021;10:1823.
18. Somdutt KS, Bhadu K, Rathore RS, Shekhawa PS. Jeevamrut and panchagavya's consequences on growth, quality and productivity of organically grown crops: A review. Agric Rev 2022;44:115-9.
19. Sudhakar JY, Ramesh S, Elankavi S. Influence of organic supplements as foliar spary on soil microbial population and yield of maize (*Zea mays*). Int J Dev Res 2011;1:61-2.
20. Arora S, Sharma JP, Chakravorty S, Sharma N, Joshi P. Indigenous Technologies in Plant Protection. New Delhi, India: ICAR -National Research Centre for Integrated Pest Management; 2016. p. 248.
21. Swarnam TP, Velmurugan AV, Jaisankar I, Roy N. Effect of foliar application of panchagavya on yield and quality characteristics of eggplant (*Solanum melongena* L). Adv Life Sci 2016;5:2636.
22. World Bank. The World Bank Annual Report. United States: World Bank; 1998.
23. Thorat JC, More AL. The effect of chemical fertilizers on environment and human health. Int J Sci Dev Res 2022;7:99.