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Sustainable Practices in Coriander Cultivation: A Comprehensive Review of Modern Techniques and Innovations"

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Abstract:

Integrated nutrient management (INM) includes the combined use of organics manures, composts, biofertilizers, green manures, crop residues, and inorganic fertilizers to increase crop yields and farmer profits, improve crop quality and minimize nutrient losses to the environment. Use of organic manures and biofertilizers such as vermicompost and nitrogen fixing bacteria has led to reduction in the application of chemical fertilizers and has provided high quality products, free of harmful agrochemicals for human safety. Use of biofertilizers can have a great complementary impact in increasing fertilizer use efficiency.

Introduction:

One of the most significant spices, vegetables, and medicinal plants, coriander (*Coriandrum sativum* L.) is a member of the Apiaceae (Umbelliferae) family and is grown year-round primarily from seeds and mostly grown in Tamil Nadu during the Rabi season. It is a native of the Mediterranean region and is grown for trade in East European, Central American, and Indian nations. India is one of the world's top producers of coriander, with an area of 4490 thousand ha and a production of 10814 thousand metric tonnes, with a productivity rate of 2.4 metric tonnes per hectare (Anon, 2022). The state of Rajasthan, Gujarat, Madhya Pradesh, Haryana, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, and Bihar are the primary growing

regions (NHB, 2017). Although it may be grown in almost any kind of soil, loamy, well-drained soil is ideal for its growth. The leaves, stalks, and pods of There are certainly countless culinary preparations which call for coriander. In India, the fresh herb can be added to salads, chutneys, and soups (Ilyas, 1980). In American English, the dried leaves of coriander or the green herb

are frequently referred to as "cilantro" (Lamberts, 1990).

Future agricultural growth relying on chemical pesticides and fertilizers will lead to additional degrading of the soil, acidification of the soil, eventual contamination of groundwater, and eventually disruption of the ecological balance. To increase the amount of nutrients that are easily available in the soil during the growth season from all beneficial sources will improve the growth of the crop. To maximize the efficacy of the soil biosphere relative to its assigned role in order to minimize the amount of nutrients lost to the environment through volatilization, denitrification, surface runoff, and leaching beyond the rooting zone. So by utilizing these conditions coriander's performance is heavily reliant on a number of variables, such as spacing, cultivation techniques, fertilizer management, and the crop's overall genetic potential.

The optimum utilization of the benefits from all potential sources of plant nutrients in an integrated way, along with the maintenance or adjustment of soil fertility and plant nutrient delivery to an optimal level for maintaining the desired production (Roy, R.N., 1995). According to Singh et al. (2006), shielded horticulture has the ability to lessen stress and counteract weather fluctuations. However, the choice of structure, crop selection, variety selection, production technology, and market price all will improve the conditions of the protected farming and how this farming will be profitable is also known (Rajasekar et al., 2013)

Inadequate management of nutrients is a primary cause of low yield and poor quality. "Maintenance of soil fertility and plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic, and biological compounds in an integrated approach" is what is meant to be understood by the acronym INM.

Utilizing organic manures is essential for maintaining agricultural yields and for enhancing soil health. The development of coriander plants, their yield, and their quality are closely correlated with organic nitrogen sources.

The least expensive form of organic matter in our nation is farm yard manure (FYM), which when treated properly aids in the provision of vital plant nutrients and promotes sustainable output. Both the microbiological activity and the physico-chemical qualities of the soil are enhanced by organic manures.

Increasing fertilizer use efficiency can be greatly enhanced by the use of biofertilizers. The symbiotic N-fixation of *Azotobacter* and PSB cultures when applied in conjunction with organic manures raises the amount of nitrogen in the soil; on the other hand, the conversion of organic or fixed phosphorus in the soil increases the availability of phosphorus. By improving plant physiology and increasing levels of resistance, balanced nutrient delivery by INM techniques lowers the frequency of disease and pest invasions (Mirchandani & Mirchandani, 2005).

By strengthening resistance power through effective feeding programs, it is possible to lessen the need for costly and dangerous pesticides, which increases farming's profitability and sustainability while also protecting the environment. However, the question of what source, or combination of sources, of nutrients would be most economical and productive under ideal growing conditions during the coriander crop's off-season needs to be addressed.

The World Health Organization (WHO, 2019) states that cardiovascular diseases (CVDs) are the leading cause of death globally. A collection of heart and blood vessel conditions known as CVDs includes deep vein thrombosis, pulmonary embolism, rheumatoid arthritis, congenital heart disease, and diseases of the coronary and peripheral arteries. The health advantages of coriander have been documented in numerous study and review papers. However, the anti-atherogenic, antihypertensive, antiarrhythmic, and hypolipidemic actions of coriander have not been included in a summary of the herb's cardioprotective effects. The phytochemicals found in *C. sativum*, including flavonoids, phenolic acids, phytosterols, and terpenes, have been shown to have potent inhibitory effects on the angiotensin-converting enzyme (ACE), as well as cardioprotective, antihyperlipidemic, and inhibitory effects on cardiometabolic disorders. These effects could have a substantial impact on cardiovascular health.

As a result, the phytochemical components of *C. sativum* were examined, enumerated, and related to the biological activities demonstrated by their presence in the corresponding extracts. Additionally, the review seeks to assess, condense, and discuss the effects of coriander extracts on the cardiovascular system across the board for all in vitro, in vivo, and clinical investigations conducted on this plant.

In addition to being economical, ecologically friendly, and sustainable, biofertilizers are also expected to become more important as an addition to or complement to inorganic fertilizers (Malhotra et al. 2006). Sharaf-Eldin and Mahfouz, et al. (2007) stated that the usage of chemical fertilizers has decreased as a result of the use of biofertilizers including various microbial strains, which have also produced high-quality products free of dangerous agrochemicals for human health. Amjad et al (2014) discussed that Micronutrients are required in small amounts for proper plant development and production, but their shortages severely disrupt the physiological and

metabolic functions of the plant. The administration of micronutrients is crucial to the production of high-yield, high-quality crops. It is commonly known that micronutrients play a part in photosynthesis, N-fixation, respiration, and other plant metabolic processes. (Naga and et al., 2013).

Researchers Mazaheri et al. (2013) evaluated the impact of micronutrient foliar fertilizer on the enhancement of growth and production of some aromatic and medicinal plants. Micronutrient application had a major impact on coriander's branch count, umbel count, umbel seed output, and number of umbels per plant. The Kalidasu group (2008)

By combining the use of organics (such as composts, green manures, biofertilizers, crop residues, etc.) and inorganic fertilizers, integrated nutrient management (INM) aims to maximize crop yields and farmer profits, enhance crop quality, and reduce nutrient losses to the environment.

Research Findings

Integrated nutrient management (INM) includes the combined use of organics (i.e. manures, composts, biofertilizers, green manures, crop residues, etc.) and inorganic fertilisers to increase crop yields and farmer profits, improve crop quality and minimise nutrient losses to the environment.

Chaithanya *et al.* (2022) studied the effect of integrated nutrient management on growth and yield of coriander and the results revealed that, among the treatments, 100% RDF + FYM (10 t ha⁻¹) + Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) + KSB (5 kg ha⁻¹) with the variety Susthira recorded significantly maximum number of days taken to harvest, number of seeds per umbel, test weight (1000 seed), seed yield per plant, seed yield per plot, seed yield per hectare.

Khalid *et al.* (2005) studied the effect Use of organic manures and biofertilizers such as vermicompost and nitrogen fixing bacteria has led to reduction in the application of chemical fertilizers and has provided high quality products, free of harmful agrochemicals for human safety.

Kumar *et al.* (2002) studied the effect of N fertilizer (0, 30, 60, or 90 kg/ha) and biofertilizer (i.e. Azotobacter, Azospirillum, and Azotobacter + Azospirillum) on the yield and quality of coriander (cv. RCr-435). They found a positive response up to 60 kg N/ha and with the use biofertilizers.

Abou and Gomma, 2002 conducted an experiment in coriander by Inoculation with *A. chroococcum* or *A. brasilense*, combined with *G. mossese* (VAM), gave significant increases in vegetative growth, total carbohydrates, photosynthetic characteristics, essential oils, seed parameters, N, P and K contents, and linalool.

Manure et al. (2000) reported that yield attributes, seed and oil yield, and oil content were all enhanced by the application of N, S, and Zn fertilisers in red, sandy loam soils,

Prabu *et al.* (2000) reported that seed yield of coriander was significantly higher with 25% recommended dose of fertilizer + FYM applied at 10 t/ha + Azospirillum + VAM over other combinations of nutrient sources and individual sources of nutrients at their recommended doses. However, Choudhary and Jat (2004) reported higher yield and net return at 100% inorganic N + Azospirillum + 5 t FYM.

The results are in conformity with Rahimi *et al.* (2009), Aishwath *et al.* (2012), Godara *et al.* (2014), Sahu *et al.* (2014) and Nisarata *et al.* (2020). They reported that the higher plant height was observed with the application of bio-fertilizers along with recommended dose of nitrogen in coriander.

Gangadharrao (2006), Yadav (2010), Hnamate *et al.* (2013), Godara *et al.* (2014) and Dadiga *et al.* (2015) found that the application of both inorganic and organic fertilizer might

have enhanced the availability of nutrients, which resulted in increased photosynthetic activity and this may be due to the cause of higher growth attributes i.e. plant height and number of branches. The combination of organic manures and fertilizer as source of nutrients ensured readily availability of nutrients for initial requirement through fertilizers and slow release in long term through organic source throughout the crop growth period.

Brar *et al.*, 2015 Studied the better growth and development might be increased due to availability of nitrogen to the plants initially through chemical fertilizers and by their FYM/organic sources, corresponding to the need of plants throughout the cropping season. Integrated use of organic and inorganic fertilizers increased crop yield and maintains long term soil fertility.

Dadiga *et al.* (2015) also reported a significant increase in growth parameters due to application of FYM with chemical fertilizers in coriander. The combined effect between micronutrient and biofertilizer levels was found no-significant influence on chlorophyll A, B and total chlorophyll content (mg/100 g) of coriander leaf. The combination effect of micronutrient and biofertilizer levels was found no-significant influence on essential oil (Linalool) content (%) in coriander. The combination effect of micronutrient and biofertilizer levels was found no-significant influence on volatile oil (Oleoresin) content (%) in coriander. The interaction effect of micronutrient and biofertilizer levels was found no-significant influence on total carbohydrate (mg/100g) in coriander. Findings are in agreement with those of Chanchan *et al.* (2013), Diana *et al.* (2015) and Mounika *et al.* (2018).

Conclusion:

Integrated nutrient management includes the combined use of organics manures, composts, biofertilizers, green manures, crop residues and inorganic fertilizers to increase crop yields. Maximum growth parameters was observed with the application of bio-fertilizers along with recommended dose of nitrogen in coriander. Micronutrients play a significant role towards improving growth, yield, and quality of seed spices.

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