Crimson Publishers
Wings to the Research

Opinion

Animal Manure Nutrition to Promote Arthropod Pest Management in Vegetable Production

Satyapriya Singh[1,2]*, Sujan Majumder[3], and Priyanka Nayak[4]

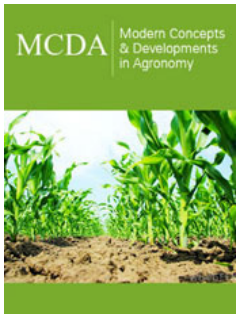
[1]Central Horticultural Experiment Station, (ICAR-IIHR), India

[2]ICAR-Indian Agricultural Research Institute, New Delhi, India

[3]ICAR-Indian Institute of Vegetable Research, India

[4]Institute of Agricultural Sciences, SOA, India

ISSN: 2637-7659



***Corresponding author:** Satyapriya Singh, Central Horticultural Experiment Station (ICAR-IIHR), Division of Entomology, Odisha, India

Submission: July 27, 2022

Published: August 09, 2022

Volume 11 - Issue 2

How to cite this article: Satyapriya Singh, Sujan Majumder, and Priyanka Nayak. Animal Manure Nutrition to Promote Arthropod Pest Management in Vegetable Production. Mod Concep Dev Agrono. 11(2). MCDA. 000759. 2022. DOI: 10.31031/MCDA.2022.11.000759

Copyright@ Satyapriya Singh. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

Introduction

Vegetables are essential and nutrient-rich dietary sources that have an indispensable role in human nutrition. It contains carbohydrates, proteins, fats, vitamins, minerals, dietary fiber, phytochemicals, and micronutrients that are involved in many metabolic reactions in the human body. In recent years, increased demand and healthy dietary need, makes vegetable production is an important domain of world trade. Globally, 314 million tonnes of vegetables were produced in 22 million hectares filed during 2019 [1]. But the biotic stress particularly arthropod pests incidence wreaks considerable economic losses in vegetable production worldwide. Plant nutrient diversity through soil fertilization could reduce insect pests' fitness. Organic and manure fertilized soils randomly distributed in agricultural landscapes may alter nutrient diversity, an important aspect of pest management. Henceforth, our study encompasses the soil fertility enrichment and adequate management of nutrients by amending animal manure is the key to maintaining soil properties in vegetable cropping that can have beneficial implications in plant growth and minimization of insect pests population that subsequently lead to sustainable production.

Maintaining healthy soil involves the deliberate management of chosen fertility supplements. Animal manure amendment: in general, can supply ample avenues of nutrients, organic matter, and microbial activity that optimize crop productivity and provide multiple benefits having water retention, nutrient cycling, and biotic stress suppression [2]. The existing report of beneficial impacts of animal manure focused on arthropod pests concentrating upon livestock wastes such as cattle (dominate globally), poultry, dairy, and vermicompost, which are available commercially. Our opinion encompasses how the animal waste has driven the host plant characteristics through soil amelioration having a direct and indirect influence on arthropod pest pressure and facilitating a healthy environment. Animal manure suppresses arthropod insect pests population can be interpreted by 'bottom up' and 'top down' effects (Figure 1). Broadly, the bottom-up effect includes the alternation of the nutritional value of the plant and strengthening of the anti-herbivore defenses whereas the recruitment and retention of beneficial natural enemies manage the pest in top-down control.

Figure 1: Schematic view of bottom-up and top-down effects on insect pest suppression.

Bottom-Up Effects

Plant nutrition, plant secondary metabolites, and rhizobiomes alter the arthropod pressure on host plants. Unlike NPK fertilizer (nitrogen, potassium, and potassium), much N in manure is in organic form and assimilates by the plant after conversion to inorganic N. Sometimes, this reduces the N availability to plant supplements with animal manure in comparison to inorganic fertilizer despite similar fertility status. Hence plants can be considered a worse host for herbivory. Moreover, augmentation of microbial activity and organic matter by animal manure can escalate nutrient retention and assimilation, favoring plant growth, and vitality and could potentially enhance plant quality for the acquisition of various micronutrients and plant toxicity, which may limit insect incidence. Similarly, P &K influence insect pressure on the host plant. K has a stronger influence on many pests' suppression. Still, an imbalance in nutrition favors plant susceptibility to arthropod pests. Henceforth, proper balance in fertility management is a prime requisite for sustainable production.

Moreover, nutritional alternation in plant tissues by animal manure enriches pest suppression by enhancing the production of defensive compounds [3]. This mechanism is influenced by micronutrients with animal manure amendment. In general, animal manure enhances microbial abundance and diversity through soil organic matter and carbon enrichment. Increasing beneficial bacteria population, particularly *Bacillus spp*., *Pseudomonas spp*. and *Trichoderma spp*. potentiates host plant defenses both direct and indirect way against insect pests [4]. Moreover, animal manure intensifies the colonization of Arbuscular Mycorrhizal Fungi (AMF) which enhances the nutrient spectrum and promotes resistance to chewing arthropods. In addition, AMF suppresses chewing pest incidence by facilitating physical defenses such as trichome, tissue hardiness, and biochemical defenses having constitutive and inducible mechanisms. On contrary, AMF elevates plant defense negatively in phloem-feeding insects that favor arthropod pests by detoxifying chemical defenses [5] influences the trade-off mechanism.

Top-Down Effect

Unlike synthetic fertilizers, animal manure amendment adds useful organic matter, that helps in boosting plant growth, supports habitat structure, enriches ecosystem services, and retains more natural enemies particularly. In addition, manure helps in the escalating abundance of decomposer and support predators. Plant volatile signaling acts as a cue for many natural enemies. Parasitoids and predators are very much tuned with specific plant cues i.e., Herbivore-Induced Plant Volatiles (HIPVs). Studies revealed manure enhances microbial activity and can activate signaling pathways in the host plant that subsequently lead to the synthesis of secondary metabolites. Both jasmonic acid and salicylic acid pathways involve in defense activation against diverse insect pest taxon and boost the resistance strategies.

Conclusion

Animal manure suppresses pest incidence and performance by exploiting bottom-up and top-down influence. Despite arthropod pest management in vegetable cultivation, the impactful advantages of animal manure include increased soil nutrients and organic matter and minimizing ecosystem and human welfare risks.

References

1. FAO F (2018) Food and agriculture organization of the United Nations. Rome.
2. Bonanomi G, Lorito M, Vinale F, Woo SL (2018) Organic amendments, beneficial microbes, and soil microbiota: toward a unified framework for disease suppression. Annu Rev Phytopathol 56: 1-20.
3. Alyokhin A, Porter G, Groden E, Drummond F (2005) Colorado potato beetle response to soil amendments: a case in support of the mineral balance hypothesis? Agric Ecosyst Environ 109(3-4): 234-244.
4. O'Brien FJM, Dumont MG, Webb JS, Poppy GM (2018) Rhizosphere bacterial communities differ according to fertilizer regimes and cabbage (*Brassica oleracea* var. *capitata L.*) harvest time, but not aphid herbivory. Front Microbiol 9: 1620.
5. Koricheva J, Gange AC, Jones T (2009) Effects of mycorrhizal fungi on insect herbivores: a meta-analysis. Ecology 90(8): 2088-2097.

For possible submissions Click below:

Submit Article

Copyright © Satyapriya Singh