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EFFECT OF DIFFERENT ORGANIC MANURES ON GROWTH, YIELD, AND PHYTOCHEMICAL PROFILE OF WITHANIA SOMNIFERA

Devasani Ramesh

Research Scholar, Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan

Dr. Anupama Gupta

Research Supervisor, Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan

ABSTRACT

Withaniasomnifera (Ashwagandha) is an important medicinal plant widely valued for its therapeutic properties and bioactive phytochemicals. The present study will evaluate the effect of different organic manures on the growth, yield, and phytochemical profile of *Withaniasomnifera*. Different organic nutrient sources will be applied to assess their influence on key growth parameters, including plant height, number of branches, leaf development, and biomass accumulation. Yield-related attributes such as root length, root weight, and overall productivity will also be evaluated under different manure treatments. In addition, phytochemical constituents, particularly total phenolics, flavonoids, alkaloids, and other bioactive compounds, will be estimated to determine the influence of organic nutrient management on medicinal quality. A suitable control treatment without organic manure will be maintained for comparison. The study will help identify effective organic manure treatments capable of improving plant growth and yield while enhancing phytochemical accumulation. The findings will contribute to sustainable cultivation and quality production of *Withaniasomnifera*.

KEYWORDS- *Withaniasomnifera*, Ashwagandha, Organic Manures, Organic Nutrient Management, Plant Growth, Root Yield, Biomass Production,

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INTRODUCTION

An essential member of the Solanaceae family, Withaniasomnifera (L.) Dunal goes by many names, including Ashwagandha and Indian ginseng. Its significant bioactive constituents, including withanolides, alkaloids, flavonoids, and phenolic compounds, as well as its various pharmacological effects, have long made it a staple in Ayurvedic treatment. Soil fertility, nutrient availability, environmental factors, and farming techniques all have an impact on the quality and production of W. somnifera. Farmyard manure, vermicompost, compost, and chicken manure are all examples of organic manures that may help with sustainable farming by improving soil structure, nutrient availability, microbial activity, and plant development. Organic nutrition sources may affect the accumulation of secondary metabolites responsible for the plant's therapeutic potential, unlike an overreliance on synthetic fertilisers. In order to find the best nutrient-management strategies that boost development, root output, biomass production, and phytochemical quality, it is crucial to evaluate various organic manures. This research will compare the impact of various organic manures on *Withaniasomnifera's* development, harvest, and phytochemical composition.

REVIEW OF LITRETURE

Patel, Payal et al., (2023) The current study was conducted during the Kharif 2021-22 season at College Farm, College of Horticulture, SardarkrushinagarDantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat, and is titled Effect of different organic sources of nutrients on quality and economics of ashwagandha [Withaniasomnifera (L.) Dunal]. Experiment was laid out in randomized block design with three replications and twenty treatments viz., T1: 100% RDN through FYM; T2: 100% RDN through Vermicompost; T3: 100% RDN through Neem cake; T4: 100% RDN through Poultry manure; T5: 80% RDN through FYM; T6: 80% RDN through Vermicompost; T7: 80% RDN through Neem cake; T8: 80% RDN through Poultry manure; T9: 60% RDN through FYM; T10: 60% RDN through Vermicompost; T11: 60% RDN through Neem cake; T12: 60% RDN through Poultry manure; T13: 80% RDN through FYM + Azotobacter + KSM + PSB; T14: 80% RDN through Vermicompost + Azotobacter + KSM + PSB; T15: 80% RDN through Neem cake+ Azotobacter + KSM + PSB; T16: 80% RDN through Poultry manure + Azotobacter + KSM + PSB; T17: 60% RDN through FYM + Azotobacter + KSM + PSB; T18: 60% RDN through Vermicompost + Azotobacter + KSM + PSB; T19: 60% RDN through Neem cake + Azotobacter + KSM + PSB; T20: 60% RDN through Poultry manure + Azotobacter + KSM + PSB. Maximum chlorophyll a, b and total at 90 DAS (at full bloom stage) (1.92, 0.75 and 2.11 mg/g, respectively)

E-mail:* *editor.jslsci888@gmail.com

and withanolides content (0.32%) at harvest were recorded with treatment T16. It was under the same treatment that we also achieved the highest net income (₹ 1,38,707/ha) and benefit cost ratio (3.52). The results show that a combination of 80% RDN via chicken manure, Azotobacter, KSM, and PSB (T16) improved ashwagandha production, quality, and economic returns.

Thakur, N S et al., (2014) The effects of nitrogen levels, tree-crop combinations, and withanolides content and yield on the growth, yield, and yield of Withaniasomnifera L. During the years 2005–2006 and 2006–2007, dunal were conducted in the central highlands of Himachal Pradesh, India. In this experiment, W. somnifera was cultivated with Prunus persica (fruit), Grewia optiva (flower), Morus alba (fodder), and Setariasphacelata (grass). Peach + Grewia + Setaria + W. somnifera, Peach + Morus + Setaria + W. somnifera, Peach + Setaria + W. somnifera, Grewia + Setaria + W. somnifera, Morus + Setaria + W. somnifera, and W. somnifera as single crop were the unique tree-crop combinations that were generated in these agroforestry systems. We used40,80, and 120 kg/ha of nitrogen on the W. somnifera plant. Combinations of trees and crops had no effect on the ashwagandha plants' stature or leaf area. The highest height (44.55 cm) and leaf area (17.76 cm2/leaf) were both achieved with a nitrogen dosage of 120 kg/ha. Plants growing in close proximity to Peach, Grewia, and Setaria had the highest leaf area index (0.97). Different tree-crop combinations had no discernible effect on belowground, aboveground, or total biomass production. There was a variation of 3.23–3.91, 2.30–2.63, and 5.53–6.46 q/ha. A total biomass yield of 8.60 q/ha, a yield of 5.23 q/ha below ground, and a yield of 3.37 q/ha above ground were all noticeably increased by the N dosage of 120 kg/ha. Nitrogen dosages and tree-crop combinations had no effect on the withanolide concentration in the roots, which ranged from 0.73 to 0.79%.

Basak, Biraj et al., (2020) As a medicinal herb and root, ashwagandha (Withaniasomnifera L. Dunal) is rich in bioactive withanolides and has industrial significance. Over the course of two years, researchers in a field experiment examined the effects on ashwagandha productivity and quality of several organic nutrient management strategies. A randomised block design (RBD) was used to conduct the experiment. The treatments included a variety of organic manures, microbial consortia, prescribed fertiliser levels, and a control group. The manures included farmyard manure, vermicompost, and castor cake. Treatments with organic manures and microbial consortia had a notable impact on the root yield metrics (root girth, length, and fresh and dried root weight) of ashwagandha, either alone or in combination. The treatment that received castor cake + microbial consortia (T7) and then vermicompost + microbial consortium (T8) had the maximum fresh and dry root yields (1505 kg ha−1) and total withanolide contents (0.947 mg g−1), respectively. The soil

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biochemical parameters (microbial biomass and enzymes) and fertility status (mineral N, available P and S) were significantly improved in the treatments that included vermicompost and castor cake. The dry root yield, withanolide content, and soil parameters were shown to have a positive connection (< 0.01) with each other (r = 0.34-0.64). The findings suggest that vermicompost and castor cake might be a great way to improve soil qualities and increase the yield of medicinal herbs.

Shrivastava, Atul & Sahu, Pankaj (2013) Using Integrated Nutrient Management (INM) treatments, the study examined the yield metrics and cost economics of Withaniasomnifera. India produces 8,429 metric tonnes of withaniasomnifera from an area of around 10,780 hectares. From 2001–2002 to 2004–2005, the yearly demand for this plant climbed from 7028 tones to 9127 tones. During the 2008–2009 and 2009–2010 Kharif seasons, the field experiment took place at the research farm of the Department of Plant Physiology at the College of Agriculture in Jabalpur, while the laboratory work was done in the Quality Laboratory at the same institution. Good drainage was present in the sandy loam soil of the experimental field, which had a pH of 7.5 and an EC of 0.18 dsm1. Soil testing showed that although available nitrogen was low at 202.0 kg•ha−1, available phosphorus was in the medium range at 16.25 kg•ha−1, and available potassium was in the medium range at 236.0 kg•ha−1. Finding the economics of different INM therapies is shown in this research. Although growing W. somnifera is becoming more popular among Indian farmers, the cultivation of this plant is neither cost-effective or lucrative because of the country's infertile soil and the high expense of chemical pesticides and fertilisers.

Desai, Chirag et al., (2017) The impact of fertiliser levels and spacing on ashwagandha's growth, yield, and quality was investigated in a field experiment. Of all the fertiliser levels tested, the one with the greatest plant height (58.11 cm), primary branch count (4.53), fresh root weight (5.43 g) and dry root weight (2.13 g) was F 3 (25-25-0 NPK kg/ha). Plant spacing with S 2 (45 cm x 15 cm) had a substantial impact on many yield features, including dry root yield per hectare (214.05 kg), seed yield (216.70 kg/ha), and quality criteria such as total withanolideproduction (1.19 kilogram/ha).

EFFECT OF ORGANIC MANURES ON GROWTH AND MORPHOLOGICAL CHARACTERISTICS OF *WITHANIA SOMNIFERA*

By enriching the soil with vital nutrients and increasing its physical, chemical, and biological characteristics, organic manures greatly aid Withaniasomnifera's growth and morphological development. Fertilisers made from organic materials, such as chicken manure, vermicompost, compost, or farmyard manure, may boost soil organic matter, make it easier to retain moisture,

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encourage more microbial activity, and help plants grow healthily by releasing nutrients gradually. The vegetative phase is a critical time for sufficient nutrition availability in W. somnifera, since this is when the plant's photosynthetic activity and biomass are at their peak. Consequently, there may be discernible differences in plant stature, branch count, leaf area, stem thickness, fresh and dry biomass, and the number of leaves produced by various organic manure treatments. While compost and manure from farms may enhance soil structure and release nutrients gradually, vermicompost has the potential to provide nutrients quickly and beneficial microbial communities. When administered at the right rates, poultry manure's relatively high nutritional content has the potential to encourage vegetative growth. When applied to soil, organic manure improves aeration, moisture availability, and nutrient accessibility, all of which contribute to greater root growth. To increase total crop performance, it is particularly beneficial to promote root development in W. somnifera, because the root is the economically significant portion of the plant. Nevertheless, the nutritional makeup, pace of application, decomposition traits, soil conditions, and environmental variables all influence the efficacy of different manures. Too much of a good thing could lead to nutritional imbalance and worse development. The best way to find out which nutrients promote favourable morphological features is to compare various organic manure treatments. Plant vitality, physiological development, and biomass output should all see improvements with organic manure-based nutrition management, all while soil health is maintained. This method may help keep W. somnifera farms afloat, which in turn might boost agricultural output and the quality of the plant's therapeutic raw materials.

IMPACT OF DIFFERENT ORGANIC MANURES ON PHYTOCHEMICAL CONSTITUENTS OF *WITHANIA SOMNIFERA*

Withaniasomnifera's medicinal value is affected by the concentration and composition of phytochemical elements, which may be dramatically altered by different organic manures. There are a number of secondary metabolites in ashwagandha that contribute to its medicinal potential, including withanolides, alkaloids, flavonoids, phenolic compounds, tannins, and saponins. The production of these phytochemicals may be influenced by the application of organic manures like compost, vermicompost, farmyard manure, or chicken manure. These manures can alter soil microbial activity, nutrient availability, moisture retention, and root-zone conditions. When plants are fed an organic diet that is both balanced and rich in nutrients, they are able to develop vigorously and produce an abundance of secondary metabolites. Specifically, the content of total phenolics and

flavonoids—chemicals linked to antioxidant activity and plant defence mechanisms—may be affected by organic manure treatments. Alterations to the plant's physiological state and the availability of nutrients may potentially cause alkaloids to accumulate. Above all else, withanolides—the main bioactive components of Willow somnifera—may differ according on factors such as genotype, climate, stage of plant growth, and nutrition management. Improved root development and a more favourable rhizosphere environment are two indirect ways in which organic manure may affect withanolide production. Farmyard manure and compost, for instance, may provide a gradual and steady source of nutrients, while vermicompost has the potential to improve nutrient availability and microbial interactions. When administered at the right rates, poultry dung has the potential to increase nutritional levels and drive metabolic activity. It is crucial to conduct a comparative evaluation since the phytochemical elements' responses may vary depending on the kind of manure and the amount of application. When nutrients are abundant, plants may grow vegetatively without producing more secondary metabolites, but when nutrients are balanced, plants may produce biomass and synthesise phytochemicals. As a result, the impact of various organic manure treatments on the phytochemical profile of W. somnifera may be better understood by a systematic study including suitable controls. These results have the potential to inform the creation of environmentally friendly farming techniques that increase output while maintaining a constant and desired phytochemical profile in medicinal plant material.

CONCLUSION

This research found that withaniasomnifera's growth, yield, and phytochemical quality may be significantly improved by using various organic manures. Improved plant growth is possible with the help of organic fertiliser sources including compost, vermicompost, farmyard manure, and chicken manure, which increase soil fertility, nutrient availability, microbial activity, and root-zone conditions. Using them might increase yield by enhancing crucial growth indicators like plant height, branching, leaf development, biomass accumulation, and root growth. The medicinal quality of Ashwagandha is determined by its phytochemicals, which include withanolides, alkaloids, phenolics, and flavonoids. The production and accumulation of these phytochemicals may be affected by organic manure treatments. Finding the right nutrient-management strategies to achieve balanced growth and phytochemical buildup may be accomplished by comparing various manure sources. In general, growing Withaniasomnifera with organic manure provides a long-term solution to improve soil health, medicinal efficacy, and productivity.

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E-mail:* *editor.jslsci888@gmail.com