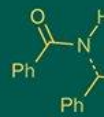


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Rajesh Budha
M.Sc. (Ag.) Horticulture (Fruit science), FASAI, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Vinay Joseph Silas
Faculty of Agricultural Sciences and Allied Industries Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Jitendra Kumar
Faculty of Agricultural Sciences and Allied Industries Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Raghvendra Singh
Faculty of Agricultural Sciences and Allied Industries Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Corresponding Author:
Rajesh Budha
M.Sc. (Ag.) Horticulture (Fruit science), FASAI, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Effect of organic manures and foliar application of (GA₃, NAA and Nanozeolite) on vegetative growth and establishment of low chilling apple (*Malus domestica*) cv. HRMN-99 under Kanpur agro climatic conditions

Rajesh Budha, Vinay Joseph Silas, Jitendra Kumar and Raghvendra Singh

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Abstract

The present investigation was conducted at the Horticulture Research Farm, Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur (U.P.) on 1 years old plant during November 2025- March 2026 with the objective to find suitable treatment of organic manures and foliar application of (GA₃, NAA and Nanozeolite) with combination of organic manures and GA₃, NAA and Nanozeolite in relation to vegetative growth and survival percentage of apple. The statistical design adopted for the experiment was randomized block design (RBD) having 03 replications and 18 treatment combinations. The Treatments were applied by soil and foliar application at initiation of experiment. The result of present investigation revealed that, the treatment T10 Vermicompost @ 5 kg per plant + GA₃ @ 200ppm was found significantly superior compared to other treatment combinations, which recorded highest mean value of survival percentage, plant height (cm), bud break (days), number of leaves per plant, number of branches per plant, number of branches per plant, plant spread (cm), stem diameter (cm) and leaf area (cm²).

Keywords: Organic manures, GA₃, NAA, Nanozeolite, apple, vegetative growth and survival percentage

Introduction

Apple (*Malus x domestica* Borkh.) is one of the most important temperate fruit crops of Northwestern Himalayan region in India. It belongs to family Rosaceae. It is liked throughout the world by all the people due to its pleasant taste and nutritional value and of its excellent taste and nutritious content; it is popular all over the world. Apple is one of the most popular fruits grown in temperate climates around the world. Its attractive look, crispy flesh, agreeable flavor, and sweet taste entice customers and bring in premium prices (Ali *et al.*, 2004) [2]. In the past it was generally regarded as a crop of the temperate zones but is increasingly cultivated under sub-tropical and even tropical conditions (Luck will 1984). This has been made possible by selection of adapted cultivars, and by both technological innovations and modifications to standard temperate-zone practices. Shri Hariman Sharma a renowned progressive farmer hailing from Paniala village of Bilaspur district has developed an apple variety that can be grown in plain, tropical and subtropical areas. This apple variety does not require chilling hours for flowering and fruit setting. He has become a source of inspiration for thousands of farmers and agriculturists of Bilaspur and other lower hill districts of the state, the areas which earlier could never dream of growing the apple fruits. The HRMN -99 variety of Apple grows at a lower altitude of 1800 feet above sea level and does not require chilling hours. It can be grown in warm environments, has a maximum height of 12 to 15 feet, begins to bear fruit after the third year of planting, blooms in early January, and can be harvested after six months (June). Seasonal pruning is required for mature plants. The ripe fruit has a yellow-red color, atypical fruit size, and a sweet-sour flavor. The fruit's only drawback is that it has a limited shelf life (about 10 12 days at room temperature). Average yield 1(quintal /plant from 7-year-old plant), and also tolerant to scab disease. In order to study the suitability and adaptability of the HRMN-99 in various agro-

climatic conditions of the country, National Innovation Foundation- India (NIF) has transplanted around 10,000 saplings at 1190 farmers' fields and 25 organizations in 29 states and 5 union territories during 2015-2017. Successful fruiting in Manipur, Madhya Pradesh, Uttar Pradesh, Bihar, Maharashtra, Gujarat, Dadra, and Nagar Haveli, Karnataka, Haryana, Rajasthan Jammu, Kerala, Uttarakhand, Telangana, Himachal and Delhi were reported which led to increasing in the demand of saplings on very large scale by the farmers throughout the country (National innovation foundation, Database 2017). Integrated nutrient management plays a significant role in achieving the sustainable fruit production without interfering with the fertility. It is a system that helps to restore and sustain crop productivity, and also assists in checking the emerging micro-nutrient deficiencies (Dolker *et al.*, 2017) ^[4]. The use of green manures such as vermicompost, FYM, in combination with chemical fertilizers has resulted in the preservation of soil's physical, chemical, and biological qualities Korwar *et al.* (2005) ^[6]. Presently growth regulators are given considerable importance for their value in regulating the various growth and development processes in plants (Thorat *et al.*, 2018) ^[12]. Plant growth regulators are the naturally occurring hormones in the higher plants for controlling growth and physiological factors. They are synthesized in one site of the plant and utilized by the other part of the plant (Kumar *et al.*, 2022) ^[7]. Their synthetic counterparts initiate a variety of biochemical and physiological processes related to plant growth and development (Sabagh *et al.*, 2021) ^[9]. Zeolites, a naturally occurring mineral group consisting of about 50 mineral types, draw attention as a good growing medium substrate for a long period due to its good physical and chemical characteristics (Markovich *et al.*).

Materials and Method

A field experiment entitled "Effect of organic manures and foliar application of (GA₃, NAA and Nanozeolite) on vegetative growth and establishment of low chilling apple (*Malus domestica*) cv. HRMN-99 under Kanpur agro climatic conditions" was undertaken at the Central field of the Faculty of Agricultural Sciences and Allied Industries Rama University, Mandhana, Kanpur (Uttar Pradesh) during 2025-2026. HRMN -99 it is a low c hilling a ppple variety noticed the resistane of an apple to climatic change in 1999 by Hariman Sharma. This new variety is resistant to scab disease. Due to higher sugar acid ratio, higher total soluble solids, attractive colour a nd and higher self-life this variety overcomes all most the demerits of low chilling apple variety. The treatment consists of three organic manures with control viz., T₀: Control, T₁ : Vermicompost @ 5 kg per plant, T₂: FYM@ 5 kg per plant and five different levels of PGRs with control viz., (F₀: Control, F₁: Nanozeolite @ 250 ppm, F₂: GA₃ @ 100ppm, F₃: GA₃ @ 200ppm, F₄: NAA @ 15ppm and F₅: NAA @ 25ppm). The experiment comprising 18 treatment combinations was laid out in Randomized Block Design (f-RBD) having three replications during 2025-2026. Treatment was randomly arranged in each replication, divided in to 2 plant. The land was given a deep ploughing with a mould board plough followed by crosss ploughing first with a disc harrow and larter by cultivator. each ploughing was followed by planking. Thereafter lay out was done. Pits were dug harving the size 60x60x60cm². Initital establishment and

vigour of the apple plant are governed in accordance with the nutrition provide along with the sources of nutrition. Planting was done at a spacing of 3mx1.5m. The biometrical observations will be recorded on three selected plants of each treatment to assess the effect of treatments on growth parameters of apple in the following characters. All the recorded observations was subjected to statistical analysis. The data on growth, yield and quality components were subjected to Fisher's method of analysis of variance (ANOVA) as outlined by Panse and Sukhatme (1985) ^[18] where the 'F' test was significant for comparison of the treatment means, CD values were worked out at 5% probability level.

Results and Discussion

The data pertaining to survival percentage indicates that the difference were significant only due to variation in sources of nutrition. Data enumerated in table 1 revealed that the effect of organic manures and foliar application of (GA₃, NAA and Nanozeolite) on survival percentage of low chilling vaiety of apple. The finding of the present investigation showed that all the plants were survived with the application of T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm, T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm, T₄ Control+ GA₃ @ 200ppm and T₃ Control+ GA₃ @ 100ppm which was recorded (100%), followed by T₂ Control+ Nanozeolite @ 250 ppm and T₅ Control+ NAA @ 15ppm, w hile minimum survival percentage (68.65) observed with treatment T₁ Control. These results are in support with Jain *et al.*, (2017) ^[16] and Dwivedi and Agnihotri (2018) ^[17]. The data on the effect of organic manures and foliar application of (GA₃, NAA and Nanozeolite) in improving vegetative growth parameters of low chilling Apple (*Malus x domestica* Borkh.) cv. HRMN-99 are presented in table 1 The Effect of organic manures and foliar application of (GA₃, NAA and Nanozeolite) in improving vegetative growth parameters of low chilling Apple (*Malus x domestica* Borkh.) cv. HRMN-99. The maximum plant height (89.33cm) at 180 days after transplanting was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the minimum plant height (53.77cm) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. These findings showed that the used increased volume of vermicompost with ombination of other organic matter as a soil application enhances the vegetative growth of apple. Similar finding were reported by Verma *et al.*, (2010) ^[13], Singh *et al.*, (2011) ^[14] and Kamatyanatti *et al.*, (2019) ^[15]. The minimum bud break (days) (10.31) was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the maximum bud break (days) (27.12) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. These findings showed that the used increased volume of vermicompost with ombination of other organic matter as a soil application enhances the vegetative growth of apple. Similar finding were reported by Verma *et al.*, (2010) ^[13], Singh *et al.*, (2011) ^[14] and Kamatyanatti *et al.*, (2019) ^[15]. The maximum number of leaves per plant (45.31) at 180 days after

transplanting was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the minimum number of leaves per plant (22.61) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. The maximum number of branches per plant (3.63) at 150 days after transplanting was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the minimum number of branches per plant (1.36) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. The maximum plant spread (cm) (257.05) at 180 days after transplanting was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the minimum plant spread (cm) (76.27) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. The maximum stem diameter (cm) (4.9) at 180 days after transplanting was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the minimum stem diameter (cm) (2.05) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. The maximum leaf area (cm²) (42.41) was found in treatment T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm. Whereas the minimum leaf area (cm²) (30.24) was found in treatment T₁ Control. Followed by T₉ Vermicompost @ 5 kg per plant + GA₃ @ 100ppm, T₁₅ FYM @ 5 kg per plant + GA₃ @ 100ppm and T₁₆ FYM @ 5 kg per plant + GA₃ @ 200ppm. Vermicompost is regarded as an outstanding source of both macro and micronutrients, beneficial microorganisms, vitamins, and substances that promote growth. Its use enhances soil structure, aeration, moisture retention, and nutrient availability, which in turn fosters root growth and nutrient absorption. Enhanced root activity subsequently leads to increased vegetative growth and establishment of plants. Similar results were documented by Abhilash Padhan *et al.* (2019) ^[1], who noted the highest plant height, leaf count, branch number, plant spread, and survival rate in low chilling apple cv. HRMN-99 under treatments based on vermicompost in the conditions of Prayagraj. The increased plant height and stem diameter observed under T₁₀ may also be attributed to the influence of GA₃ in promoting cell elongation, cell division, and cambial activity. Gibberellic acid is recognized for its ability to enhance vegetative growth by facilitating internodal elongation and the mobilization of nutrients to actively growing tissues. Comparable findings were reported by Muskan Jangid and Saket Mishra (2023) ^[8], who indicated that GA₃ at 200 ppm significantly boosted plant height and branching in low chilling apple cv. HRMN-99 under the agro-climatic conditions of Prayagraj. Additional evidence was provided by Canli and Hikmet Orhan (2019) ^[3], who discovered that the foliar application of GA₃ improved vegetative growth and seedling elongation in apple plants. The elevated percentage of bud break observed under T₁₀ may be linked to the physiological function of GA₃ in breaking dormancy and promoting metabolic processes in buds. Gibberellins boost enzymatic functions and the mobilization of

carbohydrates, leading to early and consistent bud sprouting. The increased availability of nutrients from vermicompost further facilitates active growth and the differentiation of buds. Sharma *et al.* (2025) ^[11] reported similar results regarding enhanced vegetative growth and bud activity in apple trees subjected to growth regulator treatments, noting an increase in leaf area, plant height, and leaf count following the application of GA₃ in various apple cultivars. The observed increase in plant spread, along with the number of leaves and branches per plant under the combined treatment, may be attributed to improved photosynthetic efficiency and enhanced nutrient uptake. Vermicompost provides essential nutrients gradually throughout the growth cycle, while GA₃ promotes physiological functions such as chlorophyll production, photosynthesis, and the translocation of assimilates. As a result, plants developed more vegetative shoots and foliage, contributing to a larger canopy spread. Similar enhancements in vegetative growth parameters of low chilling apple varieties were also documented in studies focusing on integrated nutrient management and bio-enhancers in HRMN-99 apple, as noted by Muskan and Mishra (2024) ^[5]. The maximum leaf area observed in T₁₀ may be due to increased cell division and elongation induced by GA₃, coupled with the continuous nutrient supply from vermicompost. A larger leaf area allows for better sunlight interception and increased photosynthetic activity, thereby enhancing overall plant vigor. Comparable findings were reported in apple and other fruit crops, where the application of organic manures and growth regulators significantly improved leaf area and vegetative parameters, as noted by Sameh *et al.* (2025) ^[10].

Conclusion

Based on the above finding, it is concluded that treatment combination T₁₀ Vermicompost @ 5 kg per plant + GA₃ @ 200ppm performed best in terms of vegetative growth and survival percentage of apple.

References

1. Abhilash Padhan, Mishra S, Bahadur V. Effect of growing media on growth, development and establishment of low chilling variety of apple "HRMN-99" under Prayagraj agro climatic conditions. J Pharmacogn Phytochem. 2019;8(3):1227-1230.
2. Ali RH, Khan MA, Hussain M. Effect of different periods of ambient storage on chemical composition of apple fruit. Int J Agric Biol. 2004;6(3):568-571.
3. Canli FA, Orhan H. Effects of foliar gibberellic acid applications on vegetative growth of pear, apple and cherry seedlings. Int J Nat Eng Sci. 2019;3(1):95-98.
4. Dolker D, Bakshi P, Wali VK, Dorjey S, Kour K, Jasrotia A. Integrated nutrient management in fruit production. Int J Curr Microbiol Appl Sci. 2017;6(7):32-40.
5. Gupta M, Mishra S. Effect of biocapsule and nanozeolite in improving growth, development and yield of low chilling apple (*Malus × domestica* Borkh.) cv. HRMN-99 in Prayagraj agro-climatic condition. J Adv Biol Biotechnol. 2024;27(8):930-937.
6. Korwar GR, Pratibha G, Ravi V, Palanikumar D. Influence of organic and inorganic nutrient sources on growth, yield of aonla (*Emblica officinalis*) and soil

- quality in semi-arid tropics. Indian J Agric Sci. 2005;76:457-461.
7. Kumar P, Singh V, Johar V, Kumar A, Kadlag SS. Uses of plant growth regulators and biofertilizers in fruit crops: a review. Int J Environ Clim Change. 2022;12(11):314-326.
 8. Muskan Jangid, Mishra S. Effect of plant growth regulators on flowering and fruit setting of low chilling apple (*Malus domestica*) cv. HRMN-99 under Prayagraj agro climatic conditions. Pharma Innov. 2023;12(5):2335-2339.
 9. Sabagh AE, Mbarki S, Hossain A, Iqbal MA, Islam MS, Raza A, *et al.* Potential role of plant growth regulators in administering crucial processes against abiotic stresses. Front Agron. 2021;3:648694.
 10. Sameh Kamel Okba, Abo Ogiela HM, Mehesen A, Mikhael GB, Alam-Eldein SM, Tubeileh AMS. Influence of compost and biological fertilization with reducing the rates of mineral fertilizers on vegetative growth, nutritional status, yield and fruit quality of 'Anna' apples. Agronomy. 2025;15(3):662.
 11. Sharma P, Sharma CL, Sankhyam N, Vibhas. Effect of foliar application of GA3 on morphological features of popular cultivars of apple (*Malus × domestica* Borkh.) under nursery conditions in mid-hill Asia. Int J Econ Plants. 2025;12(4):1-8.
 12. Thorat UK, Dheware RM, Jadhav AR. Influence of growth regulators on quality and fruit attributes of custard apple (*Annona squamosa* L.) cv. Balanaga. Int J Econ Plants. 2018;5(3):151-153.
 13. Verma A, Stellacci F. Effect of surface properties on nanoparticle-cell interactions. small. 2010 Jan 4;6(1):12-21.
 14. Singh A, Prasad SM. Reduction of heavy metal load in food chain: technology assessment. Reviews in Environmental Science and Bio/Technology. 2011 Sep;10(3):199-214.
 15. Kamatyanatti M, Kumar A, Dalal RP. Effect of integrated nutrient management on growth, flowering and yield of subtropical plum cv. Kala Amritsari. Journal of Pharmacognosy and Phytochemistry. 2019;8(1):1904-8.
 16. Jain R, Aagja J, Bagdare S. Customer experience-a review and research agenda. Journal of service theory and practice. 2017 May 8;27(3):642-62.
 17. Agnihotri A, Gupta P, Dwivedi A, Seth CS. Counteractive mechanism (s) of salicylic acid in response to lead toxicity in *Brassica juncea* (L.) Czern. cv. Varuna. Planta. 2018 Jul;248(1):49-68.
 18. Sukhatme VP, Sizer KC, Vollmer AC, Hunkapiller T, Parnes JR. The T cell differentiation antigen Leu-2/T8 is homologous to immunoglobulin and T cell receptor variable regions. Cell. 1985 Mar 1;40(3):591-7.