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IMPACT OF SOIL HEALTH AND INNOVATIVE IRRIGATION TECHNIQUES ON CARROT GROWTH AND QUALITY

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ABSTRACT

This article is about how healthy soil conditions and innovative irrigation techniques impact carrot yield. Healthy soil, with optimal texture, pH, and nutrient levels, further boosts carrot yield by providing an ideal environment for root development and nutrient uptake. Integrating advanced irrigation methods with sound soil management practices, such as incorporating organic matter and balancing fertilization, enhances overall carrot production. Effective irrigation, such as drip systems, ensures precise water delivery, preventing over- or under-watering, which supports consistent root growth and high-quality produce. This article highlights the critical role of combining these factors to maximize both yield and quality in carrot cultivation.

INTRODUCTION

Root vegetable, carrots (*Daucus carota*), is important worldwide because of their bright colour and nutritional value (Ahmad *et al.*, 2019). Carrots are an essential part of agriculture and are rich in beta-carotene, fibre, vitamins, and minerals (Nagraj *et al.*, 2020). They also contribute significantly to a balanced diet. However, environmental conditions, especially those related to soil quality and irrigation techniques, have a significant impact on their production. The development, productivity, and quality of carrots can be significantly impacted by sophisticated irrigation methods and efficient soil management. This article is about the relationship between creative irrigation techniques, healthy soil, and carrot yield.

IMPACT OF SOIL

In carrot cultivation, soil is essential since it affects the root vegetable's development, quality, and production. The ideal soil conditions for carrots

are loose, well-drained, and sandy soils that let their long taproots grow straight and unhindered. Carrots grown in heavy, clayey soils may become stunted and deformed as a result of root growth inhibition. The texture of the soil affects both water retention and aeration; too sandy soil may not hold on to enough moisture and nutrients, while excessive clay might cause water logging and poor root oxygenation (Asante, 2019). Carrots require a pH range of 6.0 to 6.8, which is slightly acidic to neutral. The pH level of the soil is also very important. Root health can be impacted by excessively acidic or alkaline soils, which might hinder nutrient availability (Ganeshamurthy *et al*., 2016). Another important consideration is nutritional content, as carrots need a balanced intake of important elements including calcium, phosphorus, and potassium. Also, carrots are particularly sensitive to deficiencies in several micronutrients, particularly boron. The majority of the time, alkaline soils are found to be lacking in this element. The result of the boron deficiency is black stains on carrot roots after washing and a stunted plant growth. Low yields and poor growth might be the result of inadequate food intake. Compost and other organic materials can also boost soil fertility by improving soil structure and nutrient availability. To maintain the ideal soil conditions for carrot growth, proper soil management techniques are crucial. These methods include frequent tilling to break up compacted layers and crop rotation to minimise nutrient depletion and disease build up. All things considered, cultivating healthy carrot plants and optimising the quality and quantity of harvests depend heavily on an awareness of and ability to successfully manage soil parameters. According to NHB, the amount of organic manure put to the crop and the fertility of the soil determine how much fertiliser is needed. 25 t/ha of well-decomposed FYM is added to the soil to get a decent yield. In general, for the best yield, 135 kg N, 135 kg P_2O_5, and 150 kg K_2O should be used. At the time of planting, 90 kg of N, P, and K are provided out of this. Forty-five days after planting, the remaining forty-five kg of N and P and sixty kg of K are applied. Fertilisers should not be applied on the soil's surface, but rather should be ploughed down to a depth of 25 cm, especially in dry weather, because feeder roots are evenly dispersed in a 25 cm layer.

IMPACT OF IRRIGATION TECHNIQUES

Carrot farming is significantly impacted by irrigation practices, which have an effect on root formation, water availability, and general plant health. Carrots require regular moisture for healthy growth and root development; thus, irrigation is essential. Carrots benefit greatly from drip irrigation since it minimises water waste and lowers the danger of illness by keeping the foliage dry. It also provides water straight to the soil surrounding the plant roots. In order to avoid the development of split or malformed roots, this technique also aids in preserving uniform soil moisture levels. Sprinkler systems are another option, but if not properly maintained, they might result in uneven moisture distribution and even soil erosion. Because damp leaves result from overhead watering, foliar infections can also be more likely. Carrot growth can be adversely affected by both overwatering and under watering, thus it is important to schedule irrigation properly. While under watering can limit development and result in inadequate root production, overwatering can result in wet soils that can harbour root rot and other issues. Carrot roots can also benefit from knowing how much water the soil can store and modifying the frequency of irrigation in accordance with that information. By using effective irrigation methods, carrots are given the proper quantity of water at the correct time, encouraging healthy development, cutting down on waste, and improving the crop's overall output and quality

(Harasim *et al.*, 2025). According to a study on **"**Carrot productivity and its physiological response to irrigation methods and regimes in arid regions", they concluded that the soil water content was greater in the drip-irrigated plots than in the surface-irrigated plots (Tlig *et al.*, 2023). Actually, drip irrigation minimises water loss through drainage or evaporation while maintaining a higher degree of hydration in the root zone. The surface approach, on the other hand, totally wets the surface soil, which increases soil evaporation.

CONCLUSION

To sum up, the productive production of carrots depends on the creative interaction of cutting-edge irrigation methods with the preservation of organic soil conditions. Precise water management, provided by advanced irrigation techniques like drip irrigation, is essential for maintaining consistent moisture levels and averting frequent problems like stunted growth or root rot. By effectively meeting water requirements, these techniques aid in the creation of carrots that are well-formed and of excellent quality. Simultaneously, strong root development and nutrient absorption depend heavily on the health of the soil, which is defined by its optimal texture, pH balance, and nutrient availability. Additional improvements to soil fertility and structure come from good soil management techniques, such as the use of organic amendments and balanced fertilisation. Growers may greatly increase carrot yields, enhance root quality, and accomplish sustainable agricultural results by using a complete strategy that incorporates both advanced irrigation techniques and strong soil management. In the end, this integrated approach contributes to the overall success of carrot production by promoting long-term soil health and optimising resource utilisation.

References

- Ahmad, T., Cawood, M., Iqbal, Q., Ariño, A., Batool, A., Tariq, R. M. S., ... & Akhtar, S. (2019). Phytochemicals in Daucus carota and their health benefits. *Foods*, *8*(9), 424.
- Asante, K. W. A. K. U. (2019). *Influence of different rates of fertilizer and biochar amendments on soil, carrot (Daucus Carota) yield and tuber quality in response to capacity needs of farmers in the transitional zone of Ghana* (Doctoral dissertation, University of Education Winneba).
- Ganeshamurthy, A. N., Kalaivanan, D., & Satisha, G. C. (2016). Management of vegetable crops in acid soils of India. *Innovations in Horticultural Sciences*, 559-584.
- Harasim, E., Kwiatkowski, C. A., & Buczek, J. (2025). Effect of Farming System and Irrigation on Nutrient Content and Health-Promoting Properties of Carrot Roots. *Agronomy*, *15*(6), 1289.
- Nagraj, G. S., Jaiswal, S., Harper, N., & Jaiswal, A. K. (2020). Carrot. *Nutritional Composition and Antioxidant Properties of Fruits and Vegetables*, 323-337.
- Tlig, W., Mokh, F. E., Autovino, D., Iovino, M., & Nagaz, K. (2023). Carrot productivity and its physiological response to irrigation methods and regimes in arid regions. *Water Supply*, *23*(12), 5093-5105.