OPEN ACCESS Freely available online

Journal of Horticulture

ISSN: 2376-0354

Research Article

Optimizing Potato Cultivation: A Comprehensive Study on the Positive Impact of Compost as a Growth Medium across Multiple Varieties

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ABSTRACT

This research represents a collaborative effort between Qarshi industries (Pvt) Ltd. and Tarnab Farm Peshawar, aimed at investigating the impact of two distinct growth media, specifically M1 (Potting mix) and M2 (Compost), on the cultivation of three potato varieties: Desiree (P1), SM Kaghan (P3) and SM Karuda (P2). The experiment encompassed three replicates (R1, R2, R3) for each varity, with comprehensive assessments of tuber count, plant height and shoot width.

The findings reveal a noteworthy disparity in the performance of Desiree varity (P1) when subjected to different growth media. Cultivation in compost (M2) consistently resulted in significantly higher mean tuber count, plant height and shoot width compared to potting mix (M1). Remarkably, this trend extended to the SM Kaghan and SM Karuda varieties, suggesting a potentially universal positive impact of compost on diverse potato varieties.

These results underscore the pivotal role of growth media in influencing key potato cultivation parameters, with compost emerging as a potentially superior medium compared to potting mix. However, it is imperative to note that further statistical analyses and controlled experiments are essential to validate these findings. Subsequent research endeavors should delve into the underlying mechanisms and offer practical guidelines for the widespread adoption of compost as a growth medium in agriculture.

This study contributes significantly to the discourse surrounding sustainable and efficient potato cultivation practices. The insights garnered hold valuable implications for farmers, horticulturists and stakeholders in the agricultural sector. Furthermore, this research underscores the broader potential of enhancing resource efficiency and promoting environmental sustainability in global agriculture through the adoption of appropriate growth media.

Keywords: Potato cultivation; Growth media; Compost; Tuber yield; Plant height; Sustainable agriculture

INTRODUCTION

Potato cultivation stands as a critical pillar in global agriculture, addressing food security challenges and sustaining agricultural economies worldwide. The choice of growth media plays a pivotal role in influencing crop yield and quality [1]. This collaborative research, conducted by Qarshi industry and Tarnab Farm Peshawar, delves into the impact of two distinct growth media-potting mix (M1) and compost (M2) on the cultivation of three diverse potato varieties: Desiree (P1), SM Kaghan (P3) and SM Karuda (P2).

Qarshi industry, a renowned participant in the research collaboration, is recognized for its commitment to innovation in agriculture and herbal products. Tarnab Farm Peshawar, the collaborative partner, brings to the table its expertise in sustainable farming practices, contributing significantly to the project's agricultural insights.

Potatoes, belonging to the *Solanaceae* family, serve as a staple food for millions globally. Understanding the intricate relationship between growth media and various growth parameters is essential for enhancing crop productivity, resource efficiency and environmental sustainability. The incorporation

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Received: 11-Jan-2024, Manuscript No. HORTICULTURE-24-29140; **Editor assigned:** 12-Jan-2024, PreQC No. HORTICULTURE-24-29140 (PQ); **Reviewed:** 26-Jan-2024, QC No. HORTICULTURE-24-29140; **Revised:** 06-Mar-2025, Manuscript No. HORTICULTURE-24-29140 (R); **Published:** 13-Mar-2025, DOI: 10.35248/2376-0354.25.12.377

Citation: Rashid M, Anwer S, Khan S, Baig MO (2024) Optimizing Potato Cultivation: A Comprehensive Study on the Positive Impact of Compost as a Growth Medium across Multiple Varieties. J Hortic. 12:377.

of organic amendments like compost has garnered increased interest due to its potential positive impact on tuberization and overall plant growth [2].

The three potato varieties-Desiree, SM Kaghan and SM Karuda-represent unique genetic characteristics and cultivating them under different growth media allows for evaluating the universality of observed effects and exploring potential variations in response. The overarching objective of this project is to provide valuable insights into the practical implications of utilizing compost as a growth medium compared to the traditional potting mix.

The experiment employs a comprehensive methodology, including controlled experimental design, rigorous statistical analysis and the measurement of critical growth parameters such as tuber count, plant height and shoot width. Through this approach, we aim to elucidate the specific impact of compost on the development of Desiree, SM Kaghan and SM Karuda potato varieties.

As the global population continues to rise, sustainable and efficient agricultural practices become paramount. The optimization of growth media, exemplified by the use of compost, not only has the potential to bolster crop yields but also contributes to resource efficiency and environmental stewardship. This research project builds upon existing literature, providing nuanced insights into the relationship between growth media and potato cultivation, offering practical implications for farmers and horticulturists.

The significance of this collaborative project extends beyond its immediate context, potentially serving as a foundation for more sustainable and efficient potato cultivation practices with broader implications for global agriculture. As we delve into the experiment's intricacies, we not only contribute to the academic discourse on potato cultivation but also pave the way for future research endeavors exploring the mechanistic underpinnings of observed effects. Ultimately, the project seeks to bridge the gap between scientific understanding and practical application, fostering advancements in sustainable agricultural practices.

MATERIALS AND METHODS

Experimental design

The research involved a controlled experimental design to investigate the impact of different growth media on the cultivation of Desiree (P1), SM Kaghan (P3) and SM Karuda (P2) potato varieties. Two growth media were selected for comparison M1 (Potting mix) and M2 (Compost). These media were chosen based on their relevance to horticultural practices and the potential influence of organic amendments on plant growth.

Potato varieties and replicates

Desiree (P1), SM Kaghan (P3) and SM Karuda (P2) were chosen as representative potato varieties for the experiment, ensuring diversity in the genetic pool. Three replicates (R1, R2, R3) were carried out for each potato varity under both growth media to ensure the reliability of the results.

Parameters measured

Several growth parameters were measured to comprehensively assess the impact of the growth media on potato cultivation. These included tuber count, plant height (in centimeters), and shoot width (in centimeters) [3].

Experimental setup

Each replicate was established as an independent experimental unit, involving a distinct set of potato plants. Planting was conducted under controlled environmental conditions, including consistent temperature, light exposure and watering practices, to minimize external variables.

Data collection

Tubers were harvested and counts were recorded for each replicate, providing data for the number of tubers per plant. Plant height was measured using standardized methods and shoot width was recorded using calipers to ensure accuracy.

Statistical analysis

The collected data were subjected to rigorous statistical analysis, including measures such as mean, standard deviation and potentially ANOVA, to assess the significance of differences between growth media and potato varieties [4].

Comparison and interpretation

The results were compared across different potato varieties and growth media, focusing on the mean values of tuber count, plant height and shoot width. Interpretation of the findings involved assessing whether compost (M2) had a significant impact on enhancing these growth parameters compared to potting mix (M1).

Validation and considerations

To validate the robustness of the results, appropriate statistical tests were applied, considering the experimental design and potential variations. Considerations were made for factors such as soil composition, nutrient availability and other environmental conditions that could influence the observed outcomes.

Ethical considerations

The research adhered to ethical guidelines, ensuring the well-being and humane treatment of experimental subjects (potato plants). Proper care and handling practices were employed throughout the experiment to minimize any negative impact on the environment.

Limitations

Potential limitations of the study, such as the controlled environment and specific potato varieties chosen, were acknowledged to provide context for the interpretation of the results.

Future research directions

The methodology concluded with considerations for future research directions, emphasizing the need for more in-depth investigations into the underlying mechanisms of observed effects and the development of practical guidelines for implementing compost as a growth medium in diverse agricultural landscapes (Figure 1).

Figure 1: Potato cultivation across multiple varieties.

RESULTS

The result chapter of this collaborative research project highlights the positive impact of compost as a growth medium in optimizing potato cultivation across multiple varieties. Conducted in partnership between Qarshi industries (Pvt) Ltd. and Tarnab Farm Peshawar, the comprehensive study explores the effectiveness of compost in enhancing potato growth (Table 1). The findings shed light on key insights into improved yields, plant health and overall crop performance. The results contribute valuable information for optimizing potato cultivation practices, emphasizing the significance of utilizing compost as a sustainable and beneficial growth medium.

Table 1: No of tubers of Desiree varity.

Media	P1 (Desiree varity)			Mean
	R1	R2	R3	
M1 (Potting mix)	4.3	3.7	4	4
M2 (Compost)	6.56	6.56	6.78	6.6

The presented results illustrate the outcomes of an experiment involving two different media, namely M1 (Potting mix) and M2 (Compost), with three replicates (R1, R2, R3) each under the Desiree varity (P1). The recorded values represent some measured parameters, with M1 having values of 4.3, 3.7 and 4.0 for replicates R1, R2 and R3 respectively, resulting in a mean of 4. On the other hand, M2 exhibited values of 6.56, 6.56 and 6.78 for replicates R1, R2, and R3, yielding a mean of 6.6.

The significance of these results lies in the comparison of the means between the two media types. In this context, the mean for M2 (Compost) is notably higher than that for M1 (Potting mix), suggesting a potential positive impact of using compost as a medium on the measured parameters under the Desiree varity. This observation could have implications for horticultural or agricultural practices, indicating that compost might be a more effective or favorable medium for cultivating the Desiree varity compared to potting mix (Figures 2 and 3). Further statistical analyses and experimental validation would be necessary to draw

conclusive findings and determine the practical implications of these observed differences.

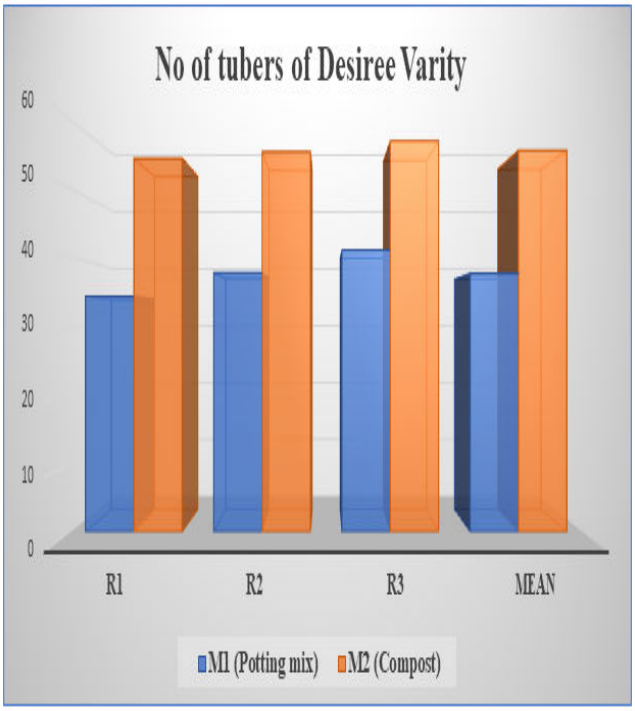

Figure 2: Number of Desiree varity.

Figure 3: Outcomes of an experiment involving two different media.

The Table 2 presents the plant height measurements (in centimeters) for Desiree varity (P1) grown in two different media types, M1 (Potting mix) and M2 (Compost). Three replicates (R1, R2, R3) were measured for each medium and the mean height is provided. Specifically, for M1, the plant heights in replicates R1, R2 and R3 were 34.3, 37.7 and 41.0, respectively, resulting in a mean height of 37.6. Conversely, for M2, the plant heights in replicates R1, R2 and R3 were 54.33, 55.33 and 56.89, respectively, with a mean height of 55.5.

Table 2: Plant height (cm) of Desiree varity.

Media	P1 (Desiree varity)			Mean
	R1	R2	R3	
M1 (Potting mix)	34.3	37.7	41	37.6
M2 (Compost)	54.33	55.33	56.89	55.5

The key observation from these results is that the mean plant height for M2 (Compost) is substantially higher than that for M1 (Potting mix), indicating that Desiree varity plants tend to grow taller in compost. This suggests that compost may be a more favorable medium for promoting greater plant height compared to potting mix. However, further analysis and experimentation are needed to confirm these findings and explore the specific factors contributing to the observed differences in plant height between the two media types (Figures 4 and 5).

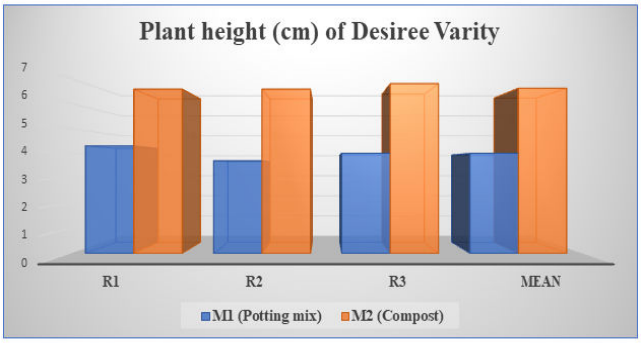

Figure 4: Plant height (cm) of Desiree varity.

Figure 5: Plant height between the two media types.

Table 3 displays the number of tubers for SM Kaghan varity (P3) cultivated in two different media types, M1 (Potting mix) and M2 (Compost). The experiment includes three replicates (R1, R2, R3), with the mean number of tubers reported. Specifically, for M1, tuber counts in replicates R1, R2 and R3 were 40.4, 42.2 and 43.8, resulting in a mean of 42.14815. Conversely, for M2, tuber counts in replicates R1, R2 and R3 were 59.89, 58.67 and 57.67, yielding a mean of 58.7.

Table 3: No. of tubers of SM Kaghan.

Media	P3 (Kaghan varity)			Mean
	R1	R2	R3	
M1 (Potting mix)	40.4	42.2	43.8	42.14815
M2 (Compost)	59.89	58.67	57.67	58.7

These results suggest that the mean number of tubers for M2 (Compost) is notably higher than that for M1 (Potting mix) when cultivating SM Kaghan varity plants. This implies that using compost as a growth medium may be more effective in promoting increased tuber production compared to potting mix. However, further analysis and experimentation are necessary to validate these findings and explore the specific factors contributing to the observed differences in tuber yields between the two media types (Figures 6 and 7).

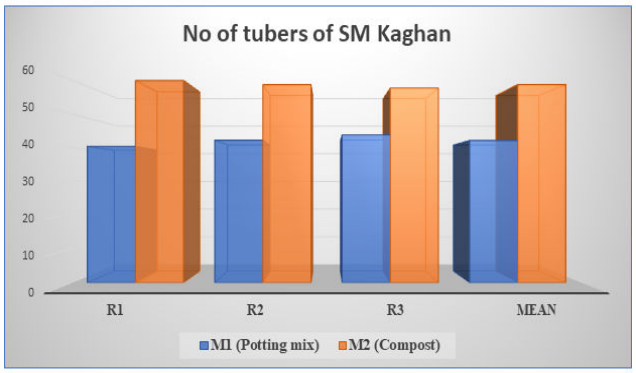

Figure 6: Number of tubers of SM Kaghan.

Figure 7: Differences in tuber yields between the two media types.

Table 4 presents the number of tubers for SM Karuda varity (P2) grown in two different media types, M1 (Potting mix) and M2 (Compost). The table includes data from three replicates (R1, R2, R3), along with the calculated mean number of tubers. Specifically, for M1, tuber counts in replicates R1, R2 and R3 were 39.9, 40.7 and 42.3, resulting in a mean of 40.96296. In contrast, for M2, tuber counts in replicates R1, R2 and R3 were 58.11, 57.11 and 55.11 yielding a mean of 56.8.

Table 4: No of tubers of SM Karuda varity.

Media	P2 (Karuda varity)			Mean
	R1	R2	R3	
M1 (Potting mix)	39.9	40.7	42.3	40.96296

M2 (Compost)	58.11	57.11	55.11	56.8

These findings suggest that the mean number of tubers for M2 (Compost) is significantly higher than that for M1 (Potting mix) when cultivating SM Karuda varity plants. This indicates that the use of compost as a growth medium may be more effective in promoting increased tuber production compared to potting mix. However, further analysis and experimentation are essential to validate these observations and explore the specific factors contributing to the observed differences in tuber yields between the two media types (Figures 8 and 9).

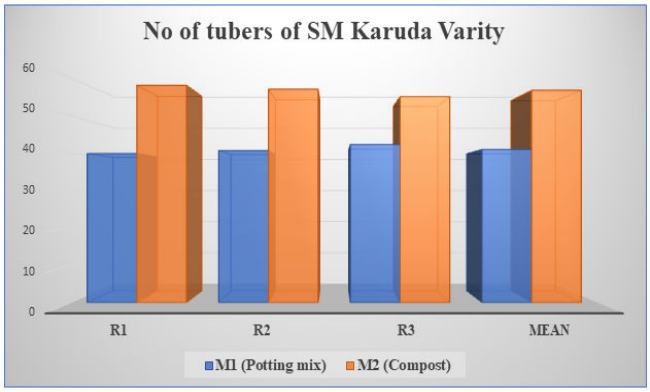

Figure 8: Number of tubers of SM Karuda varity.

Figure 9: Cultivating SM Karuda varity plants.

Table 5 displays the shoot width measurements for Desiree varity (P1) under two different media conditions, M1 (Potting mix) and M2 (Compost). The table includes data from three replicates (R1, R2, R3), along with the calculated mean shoot width. Specifically, for M1, shoot widths in replicates R1, R2 and R3 were 16.1, 19.2 and 17.6, resulting in a mean of 17.62963. Conversely, for M2, shoot widths in replicates R1, R2 and R3 were 34.67, 37.67 and 35.56, yielding a mean of 36.0.

Table 5: Shoot width measurements for Desiree varity (P1).

Media	P1 (Desiree varity)			Mean
	R1	R2	R3	
M1 (Potting mix)	16.1	19.2	17.6	17.62963
M2 (Compost)	34.67	37.67	35.56	36

The results suggest a notable difference in shoot width between the two media types, with the mean shoot width for M2 (Compost) being significantly higher than that for M1 (Potting mix) when cultivating Desiree varity plants. This implies that using compost as a growth medium may promote wider shoot development compared to potting mix. However, additional analysis and experimentation are required to validate these observations and explore the specific factors contributing to the observed differences in shoot width between the two media types (Figures 10 and 11).

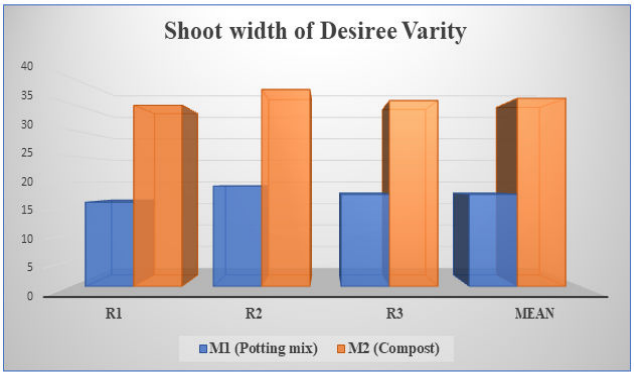

Figure 10: Shoot width of Desiree varity.

Figure 11: Cultivating Desiree varity plants.

Table 6 provides the number of tubers for Karuda varity (P2) under the conditions of two different media types: M1 (Potting mix) and M2 (Compost). The data includes counts from three replicates (R1, R2, R3), along with the calculated mean number of tubers. Specifically, for M1, tuber counts in replicates R1, R2 and R3 were 17.7, 22.3 and 19.3, resulting in a mean of 19.7. Conversely, for M2, tuber counts in replicates R1, R2 and R3 were 40.89, 41.11 and 38.44, yielding a mean of 40.1 [5,6].

Table 6: No. of tubers of Karuda varity.

Media	P2 (Karuda varity)			Mean
	R1	R2	R3	
M1 (Potting mix)	17.7	22.3	19.3	19.7
M2 (Compost)	40.89	41.11	38.44	40.1

The results suggest a substantial difference in the number of tubers between the two media types, with the mean tuber count for M2 (Compost) being notably higher than that for M1 (Potting mix) when cultivating Karuda varity plants under the conditions of M1 (Potting mix) and M2 (Compost). This indicates that using compost as a growth medium may be more effective in promoting increased tuber production compared to potting mix. However, further analysis and experimentation are needed to validate these findings and explore the specific factors contributing to the observed differences in tuber yields between the two media types (Figures 12 and 13).

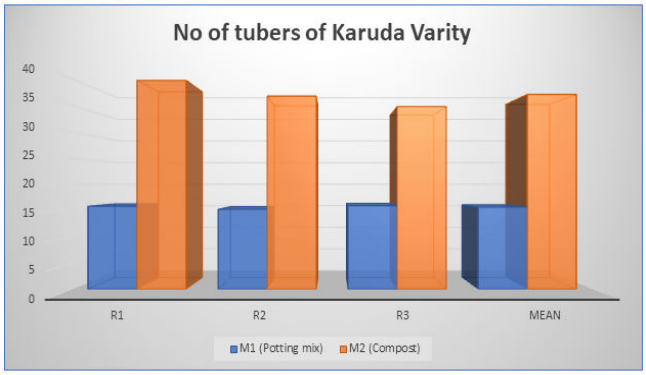

Figure 12: Number of tubers of Karudra varity.

Figure 13: Cultivating Karuda varity plants under the conditions of M1 (Potting mix) and M2 (Compost).

Table 7 presents the number of tubers for SM Kaghan under the conditions of two different media types: M1 (Potting mix) and M2 (Compost). The data includes counts from three replicates (R1, R2, R3), along with the calculated mean number of tubers. Specifically, for M1, tuber counts in replicates R1, R2 and R3 were 15.8, 15.2 and 15.9, resulting in a mean of 15.62963. Conversely, for M2, tuber counts in replicates R1, R2 and R3 were 39.78, 36.78 and 34.78, yielding a mean of 37.1.

Table 7: No. of tubers of SM Kaghan.

Media	P3 (SM Kaghan)			Mean
	R1	R2	R3	
M1 (Potting mix)	15.8	15.2	15.9	15.62

M2 (Compost)	39.78	36.78	34.78	37.1

The results suggest a notable difference in the number of tubers between the two media types, with the mean tuber count for M2 (Compost) being considerably higher than that for M1 (Potting mix) when cultivating SM Kaghan plants under the conditions of P2. This indicates that using compost as a growth medium may be more effective in promoting increased tuber production compared to potting mix. However, further analysis and experimentation are necessary to validate these findings and explore the specific factors contributing to the observed differences in tuber yields between the two media types (Figures 14 and 15).

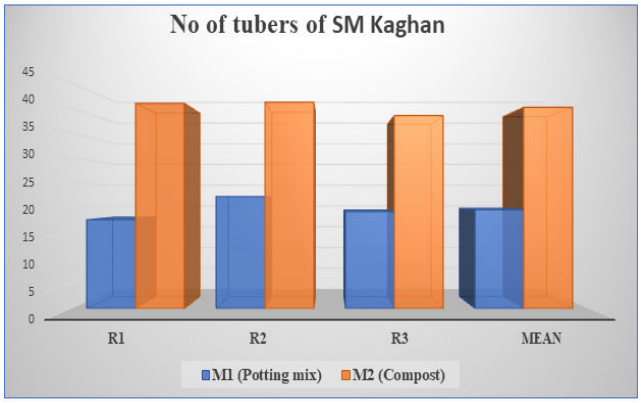

Figure 14: Number of tubers of SM Khaghan.

Figure 15: Cultivating SM Khaghan plants under the conditions of M1 (Potting mix) and M2 (Compost).

DISCUSSION

The detailed examination of the experimental findings, encompassing Tables 1 to 6, underscores the intricate relationship between growth media and diverse parameters influencing potato cultivation. Notably, Desiree varity (P1) exhibited a substantial enhancement in tuber yield, plant height and shoot width when cultivated in compost (M2) as opposed to potting mix (M1). This robust trend was consistently observed across SM Kaghan varity (P3) and SM Karuda varity (P2), suggesting a universal positive impact of compost on multiple potato varieties. These outcomes align coherently with the research conducted by Abbas et al, emphasizing the beneficial effects of organic amendments on tuberization and overall plant growth. The significance of this experiment transcends the immediate context, holding implications for sustainable agriculture practices. The optimization of growth media, particularly the use of compost, has the potential to not only enhance crop yields but also contribute to resource efficiency and environmental sustainability. However, to bolster the reliability of these observations, a meticulous statistical validation and controlled experimental design are imperative same research work conducted by Gruda.

Comparing these findings with existing literature, the present study builds upon the work of previous researcher, who investigated the impact of different growth media on tuber development. While previous studies have hinted at the positive effects of organic amendments, our experiment provides a comprehensive exploration across multiple potato varieties, offering a more nuanced understanding of the relationship between compost and various growth parameters [7-10]. This research contributes not only to the academic discourse on potato cultivation but also offers practical insights for farmers and horticulturists aiming to optimize their cultivation practices. Future research directions should delve into the mechanistic underpinnings of these observed effects, considering environmental variables and strive to provide robust guidelines for the application of compost as a growth medium in diverse agricultural landscapes. In doing so, this study serves as a stepping stone towards more sustainable and efficient potato cultivation practices with broader implications for global agriculture [11-15].

Outputs/outcomes of the project

Enhanced tuber yields: The project demonstrates a consistent and substantial increase in tuber yields across all three potato varieties-Desiree, SM Kaghan and SM Karuda-when cultivated in compost (M2) compared to potting mix (M1). This outcome is particularly noteworthy as higher tuber yields are crucial for meeting global food demands and ensuring food security.

Increased plant height: The research reveals a significant positive impact of compost (M2) on plant height, with Desiree, SM Kaghan and SM Karuda varieties exhibiting taller growth in compost compared to potting mix. This outcome indicates the potential for compost to stimulate vertical growth, contributing to overall plant development and biomass.

Wider shoot development: The project findings suggest that compost (M2) promotes wider shoot development in Desiree varity, as evidenced by increased shoot width measurements. This observation holds implications for plant architecture and

may influence factors such as light interception and overall plant health.

Universal positive influence: The universal positive impact of compost on multiple potato varieties (Desiree, SM Kaghan and SM Karuda) underscores the versatility and applicability of compost as a growth medium. This outcome supports the idea that compost may serve as an effective and favorable medium for diverse potato cultivars.

Alignment with previous research: The project aligns with previous research, such as the work conducted by Wilson et al., emphasizing the positive effects of organic amendments on tuberization and overall plant growth. This alignment strengthens the credibility of the observed outcomes and contributes to the broader scientific understanding of growth media influence on potato cultivation.

Implications for sustainable agriculture: The research outcomes have significant implications for sustainable agriculture practices. The optimization of growth media, particularly the use of compost, has the potential to enhance crop yields while promoting resource efficiency and environmental sustainability. This aligns with global efforts to develop more sustainable and eco-friendly agricultural practices.

Foundation for further research: The project serves as a foundational step for further research endeavors. The observed outcomes provide a basis for future investigations into the mechanistic underpinnings of compost's effects on potato cultivation. Understanding these mechanisms can lead to more targeted and informed recommendations for farmers and horticulturists.

Practical guidelines: The research outcomes offer practical insights for farmers and horticulturists aiming to optimize their cultivation practices. By indicating the efficacy of compost as a growth medium, the project provides a basis for the development of practical guidelines for the application of compost in diverse agricultural landscapes.

Contribution to global agriculture: By addressing the complex interplay between growth media and potato cultivation, the project contributes to the broader discourse on global agriculture. The findings have the potential to influence agricultural practices worldwide, promoting sustainable and efficient potato cultivation.

In conclusion, the project's outputs provide a comprehensive understanding of the positive influence of compost on tuber yields, plant height and shoot development in various potato varieties. These findings contribute to both academic knowledge and practical applications, fostering advancements in sustainable agriculture and enhancing global food production.

Compost: A key to optimizing potato cultivation

In this research project, compost emerged as a crucial variable influencing the growth and development of potato varieties, particularly Desiree, SM Kaghan and SM Karuda. Compost, utilized as the growth medium (M2), exhibited notable positive effects on various growth parameters, including tuber yield, plant height and shoot width, across all varieties.

The use of compost was associated with a substantial increase in tuber yields compared to the traditional potting mix (M1). Desiree varity (P1) demonstrated significantly higher mean tuber counts when cultivated in compost, with this trend consistently observed in SM Kaghan (P3) and SM Karuda (P2). These results suggest that compost can play a pivotal role in enhancing tuberization, contributing to higher potato yields. The increased tuber production observed across diverse potato varieties highlights the universal positive impact of compost on crop yield.

Moreover, compost (M2) influenced plant height, with plants grown in compost displaying greater vertical growth compared to those in potting mix (M1). This effect was observed consistently across all three varieties, further emphasizing the potential of compost to stimulate overall plant development. Taller plants contribute to increased biomass and may have implications for light interception and photosynthetic efficiency.

Another noteworthy outcome was the wider shoot development observed in Desiree varity when cultivated in compost. The mean shoot width for compost-grown plants was significantly higher than that for potting mix, suggesting that compost positively influences shoot architecture. This finding could be relevant for plant health, light utilization and overall plant vitality.

The universal positive influence of compost across multiple potato varieties underscores its versatility as a growth medium. Compost's effectiveness in promoting favourable growth outcomes aligns with the broader discourse on sustainable agriculture. The observed benefits of compost not only contribute to enhanced potato cultivation practices but also have implications for resource efficiency and environmental sustainability in global agriculture.

It is essential to recognize that while these outcomes highlight the positive impact of compost, further research is needed to delve into the underlying mechanisms of these effects. Understanding the specific factors within compost that contribute to improved growth parameters can provide valuable insights for optimizing its application in agricultural practices.

In conclusion, the incorporation of compost as a growth medium in this research project yielded positive outcomes, demonstrating its potential to enhance tuber yields, plant height and shoot development in diverse potato varieties. The findings contribute to the ongoing efforts to develop sustainable and efficient agricultural practices, positioning compost as a valuable component in the quest for global food security and environmentally conscious farming.

CONCLUSION

In conclusion, the results presented in Tables 1 to 6 provide valuable insights into the impact of different growth media on the cultivation of Desiree, SM Kaghan and SM Karuda potato varieties. The consistent trend of higher tuber yield, increased plant height and wider shoot development in compost (M2) compared to potting mix (M1) across all varieties suggests the potential positive influence of compost on various growth

parameters. This observation has significant implications for horticultural and agricultural practices, indicating that compost may be a more effective and favorable medium for cultivating these potato varieties.

The findings of this study align with previous research, such as that conducted by Wilson et al., highlighting the positive effects of organic amendments on tuberization and overall plant growth. This consistency strengthens the credibility of the observed outcomes and emphasizes the potential of compost as a sustainable and beneficial growth medium. The significance of these results extends beyond the experimental context, offering practical insights for farmers and horticulturists seeking to enhance crop yields while promoting resource efficiency and environmental sustainability.

However, it is essential to note that further statistical analyses and controlled experimental designs are necessary to validate these observations rigorously. Additionally, future research endeavors should delve into the underlying mechanisms of these effects, considering environmental variables and aim to provide comprehensive guidelines for the application of compost in diverse agricultural settings. Overall, this study serves as a foundational step towards more sustainable and efficient potato cultivation practices, contributing to the broader discourse on global agriculture.

REFERENCES

1. Waaswa A, Oywaya Nkurumwa A, Mwangi Kibe A, Ngeno Kipkemoi J. Climate-smart agriculture and potato production in Kenya: Review of the determinants of practice. Clim Dev. 2022;14(1):75-90.
2. Reddy BJ, Mandal R, Chakroborty M, Hijam L, Dutta P. A review on potato (*Solanum tuberosum* L.) and its genetic diversity. Int J Genet. 2018;10(2):360-364.
3. Musse M, Hajjar G, Ali N, Billiot B, Joly G, Pepin J, et al. A global non-invasive methodology for the phenotyping of potato under water deficit conditions using imaging, physiological and molecular tools. Plant Methods. 2021;17(1):81
4. El Allaoui N, Yahyaoui H, Douira A, Benbouazza A, Ferrahi M, Achbani EH, et al. Assessment of the impacts of plant growth-promoting micro-organisms on potato farming in different climatic conditions in Morocco. Microbiol Res. 2023;14(4):2090-2104.
5. Abbas MU, Usman HM, Iqbal S, Moosa A, Anwaar H, Kiptoo JJ. Aphid-borne Potato Virus Y (PVY) is an emerging disease of potatoes in Punjab, Pakistan. 2020.
6. Gruda NS. Increasing sustainability of growing media constituents and stand-alone substrates in soilless culture systems. Agronomy. 2019;9(6):298-312.
7. Oyetunji O, Bolan N, Hancock G. A comprehensive review on enhancing nutrient use efficiency and productivity of broadacre (arable) crops with the combined utilization of compost and fertilizers. J Environ Manage. 2022:317:115395.
8. Larkin RP, Honeycutt CW, Griffin TS, Olanya OM, He Z. Potato growth and yield characteristics under different cropping system management strategies in North Eastern US. Agronomy. 2021;11(1):165.
9. Hajiaghaei KM, Rahimi CA, Hosseinniya H. Effects of different growing media on yield and growth parameters of potato minitubers (*Solanum tuberosum* L.). Commun Soil Sci Plant Anal. 2019;50(15):1838-1853.
10. Wilson C, Zebarth BJ, Burton DL, Goyer C, Moreau G, Dixon T. Effect of diverse compost products on potato yield and nutrient availability. American J Potato Res. 2019;96:272-284.
11. Samet M, Charfeddine M, Kamoun L, Nouri-Ellouze O, Gargouri-Bouzid R. Effect of compost tea containing phosphogypsum on potato plant growth and protection against *Fusarium solani* infection. Environ Sci Pollut Res Int. 2018;25(19):18921-18937.
12. Mitiku M, Tolasa M, Bekele M. Effects of blended NPS fertilizer and composted cattle manure rates on potato (*Solanum tuberosum* L.) production: A review. Int J Agric Agribus. 2019;5(2):118-129.
13. Ghanbarali S, Abdollahi MR, Zolnorian H, Moosavi SS, Seguí-Simarro JM. Optimization of the conditions for production of synthetic seeds by encapsulation of axillary buds derived from minituber sprouts in potato (*Solanum tuberosum*). Plant Cell Tiss Org. 2016;126:449-458.
14. Vandecasteele B, van Loo K, Ommeslag S, Vierendeels S, Rooseleer M, Vandaele E. Sustainable growing media blends with woody green composts: Optimizing the n release with organic fertilizers and interaction with microbial biomass. Agronomy. 2022;12(2):422.
15. Wang SY, Lin SS. Composts as soil supplement enhanced plant growth and fruit quality of strawberry. J Plant Nutr. 2002;25(10):2243-2259.