



# Evaluating the Efficacy of Vermiwash Foliar Spray on Yield and Nutrient Uptake in Okra

**Shubham S. Palve<sup>a++</sup>, Suyash C. Gaikwad<sup>a++</sup>,  
Aishwarya V. Balpande<sup>a++</sup>, Reshma G. Pondkule<sup>a#</sup>  
and Shashianand U. Kalbhor<sup>b++</sup>**

<sup>a</sup> Division of Soil Science, Dr Sharadchandra Pawar College of Agriculture, Baramati, Maharashtra, India.

<sup>b</sup> Division of Entomology, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharashtra, India.

## **Authors' contributions**

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## **Article Information**

DOI: <https://doi.org/10.9734/arja/2024/v17i4608>

## **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/126237>

**Original Research Article**

**Received: 10/09/2024**  
**Accepted: 13/11/2024**  
**Published: 27/11/2024**

## **ABSTRACT**

A field experiment was conducted during the Kharif season of 2023-24 at the Division of Soil Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati to assess the efficacy of vermiwash foliar spray on yield and nutrient uptake in okra. The experiment was arranged in a Randomized Block Design (RBD) with three replications included eight treatments (T1-T8) with combinations of GRDF and vermiwash sprays applied at 30, 38 and 46 DAS and evaluated yield

<sup>++</sup> PG Scholar;

<sup>#</sup> Assistant Professor;

<sup>\*</sup>Corresponding author: E-mail: [palveshubham424@gmail.com](mailto:palveshubham424@gmail.com);

**Cite as:** Palve, Shubham S., Suyash C. Gaikwad, Aishwarya V. Balpande, Reshma G. Pondkule, and Shashianand U. Kalbhor. 2024. "Evaluating the Efficacy of Vermiwash Foliar Spray on Yield and Nutrient Uptake in Okra". Asian Research Journal of Agriculture 17 (4):964-69. <https://doi.org/10.9734/arja/2024/v17i4608>.

along with the uptake of macronutrients (N, P, K) and micronutrients (Fe, Mn, Zn, Cu). The application of vermiwash foliar sprays significantly enhanced the nutrient uptake of N, P and K in okra. The highest yield (26.66-ton ha<sup>-1</sup>) and nutrient uptake, including N (76.83 kg ha<sup>-1</sup>), P (21.60 kg ha<sup>-1</sup>), K (49.06 kg ha<sup>-1</sup>), Fe (819.1 g ha<sup>-1</sup>), Mn (479.12 g ha<sup>-1</sup>), Zn (153.63 g ha<sup>-1</sup>) and Cu (203.45 g ha<sup>-1</sup>) were observed in T8 (100% GRDF + 30% vermiwash) followed by T7, T6 and T5. Treatments with lower vermiwash concentrations showed reduced nutrient uptake, and statistical analysis revealed significant differences among the treatments. It was concluded that combining higher concentrations of vermiwash with GRDF significantly improves okra yield and nutrient uptake.

**Keywords:** Vermiwash; foliar spray; GRDF; nutrient uptake; okra yield.

## 1. INTRODUCTION

“Okra (*Abelmoschus esculentus* L.) generally known as lady's finger, is a widely cultivated vegetable crop, particularly in tropical and subtropical regions” (Akanbi et al., 2010). “It is valued for its rich nutritional profile, including essential vitamins, minerals, and dietary fibre, making it a crucial component of traditional diets” (Farindeet al., 2007). “Okra plays an important role in food security, especially in developing countries, due to its ability to thrive in various soil types and climates” (Akanbi et al., 2010). However, achieving optimal yield and fruit quality often depends on effective nutrient management strategies (Rao and Rao, 2015). “As a result, okra is frequently examined in research on sustainable agricultural practices, such as the application of organic amendments and bio-enhancers like vermiwash, which have been shown to enhance nutrient uptake and improve plant growth” (Ansari and Sukhraj, 2010). “Investigating these sustainable practices is essential for boosting okra productivity while maintaining environmental sustainability” (Singh et al., 2020).

## 2. MATERIALS AND METHODS

### 2.1 Experimental Site and Location

The experiment was carried out during *kharif* (2023-24) at Research Farm of Division of Soil Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharashtra (India). The location of the experimental farm lies between 18.14<sup>o</sup> latitude and 74.54<sup>o</sup> longitude. The experimental site's initial soil sample had a slightly alkaline pH of 8.4 and normal electrical conductivity (0.44 dS/m). Organic carbon content was medium (0.47%), while the soil was somewhat calcareous (5.84%). The soil was low in accessible nitrogen, moderate in phosphate, and relatively high in potassium, with adequate quantities of micronutrients.

### 2.2 Experimental Design and Crop Management

The experiment was laid out in a randomized block design with eight treatments and three replications. The unit plot size for each treatment was 5.50 m x 1.2 m. The hybrid variety of okra, Radhika, was sown at a spacing of 60 cm x 30 cm during the Kharif season of 2023-2024. Different concentrations of vermiwash, in combination with the General Recommended Dose of Fertilizers (GRDF), were applied in eight different treatment combinations (T<sub>1</sub>-T<sub>8</sub>). The treatments were as follows: T<sub>1</sub>: GRDF + Water spray; T<sub>2</sub>: 100% GRDF (150:100:100 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O kg ha<sup>-1</sup>); T<sub>3</sub>: 75% GRDF + 10% Vermiwash spray; T<sub>4</sub>: 75% GRDF + 20% Vermiwash spray; T<sub>5</sub>: 75% GRDF + 30% Vermiwash spray; T<sub>6</sub>: 100% GRDF + 10% Vermiwash spray; T<sub>7</sub>: 100% GRDF + 20% Vermiwash spray; and T<sub>8</sub>: 100% GRDF + 30% Vermiwash spray.

### 2.3 Crop Yield

#### 2.3.1 Fruit yield per plant

The fruit weight per plant was measured from five randomly tagged plants in each treatment and the weight for each replication was recorded at each harvest. The total weight of fruits harvested in each picking was computed, averaged and expressed in weight per plant in grams.

#### 2.3.2 Fruit yield per plot

The weight of fruits harvested from each picking was recorded from each plot (including the tagged plants) and total yield per plot estimated by adding the yield of all the harvest expressed in kilograms per plot.

#### 2.3.3 Fruit yield per hectare

Every week marketable fruits were picked from each plot and total yield was noted and

calculated on ha<sup>-1</sup> basis by using formulae given below.

$$\text{Fruit yield (ton ha}^{-1}\text{)} = \text{Fruit yield (Kg plot}^{-1}\text{)} / \text{Net plot area (m}^2\text{)} \times 10$$

## 2.4 Nutrient Uptake

Plant samples were collected from each plot after the final harvest and were washed first with ordinary water and then with distilled water. The samples were dried in an oven at 60 ± 5°C for 72 hours. Once dried, the samples were ground in a steel grinder to ensure thorough mixing of the plant material and stored in butter paper bags for further nutrient content analysis, including nitrogen (N), phosphorus (P), potassium (K), iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu). Nitrogen estimation involved separate digestion using concentrated H<sub>2</sub>SO<sub>4</sub> and a digestion mixture, as determined by the micro-Kjeldahl method outlined in AOAC (1970). For P, K, Fe, Mn, Zn and Cu. The prepared plant samples were digested using a di-acid mixture of HNO<sub>3</sub> and HClO<sub>4</sub> (3:1), following the procedure described by Jackson (1973). "Phosphorus in the digest was measured using the vanado-molybdate yellow colour method" (Jackson, 1973), while potassium was analyzed on a flame photometer based on the methods of Chapman and Pratt (1961). "The micro-nutrient cations (Fe, Mn, Zn and Cu) were determined using an atomic absorption spectrophotometer" (Zoroski and Burau, 1977). Nutrient uptake of N, P, K, Fe, Mn, Zn and Cu by okra fruits, stover and roots at harvest was calculated using the following formula.

$$\text{Nutrient uptake (kg ha}^{-1}\text{)} = \text{Nutrient content (\%)} \times \text{Dry matter yield (kg ha}^{-1}\text{)} / 100$$

The total nutrient uptake was calculated as the sum of nutrient uptake by fruits, stover, and roots. The uptake of macronutrients (N, P and K) was expressed in kg ha<sup>-1</sup> micronutrients viz., (Fe, Cu, Zn and Mn) were expressed in g ha<sup>-1</sup>.

## 2.5 Statistical Analysis

The data generated after the chemical and physical observations recorded from soil and plant as per the scheduled programme mentioned above was statistically analysed by adopting Randomized Block Design (RBD) as suggested by Panse and Sukhatme (1985).

## 3. RESULTS AND DISCUSSION

### 3.1 Yield

A substantial variation existed across the treatments regarding the fruit production of okra (Table 1, Fig.1). Among all the treatments the highest fruit yield of okra 26.66 ton ha<sup>-1</sup> was recorded in T<sub>8</sub> followed by T<sub>7</sub> (25.33 ton ha<sup>-1</sup>), T<sub>6</sub> (25.02 ton ha<sup>-1</sup>) and (75% GRDF + 30% Vermiwash Spray) (23.18 ton ha<sup>-1</sup>) which were at par with each other. However, T<sub>4</sub> (22.40 ton ha<sup>-1</sup>) followed by T<sub>3</sub> (21.25 ton ha<sup>-1</sup>) was at par with T<sub>2</sub> (19.83 ton ha<sup>-1</sup>) and T<sub>1</sub> (18.54 ton ha<sup>-1</sup>) recorded the lowest yield. Similar results were aligned by Dwivedi et al. (2018) who found a significant increase in fruit yield per plant with the application of vermicompost, NPK and vermiwash.

### 3.2 Nutrient Uptake by Crop

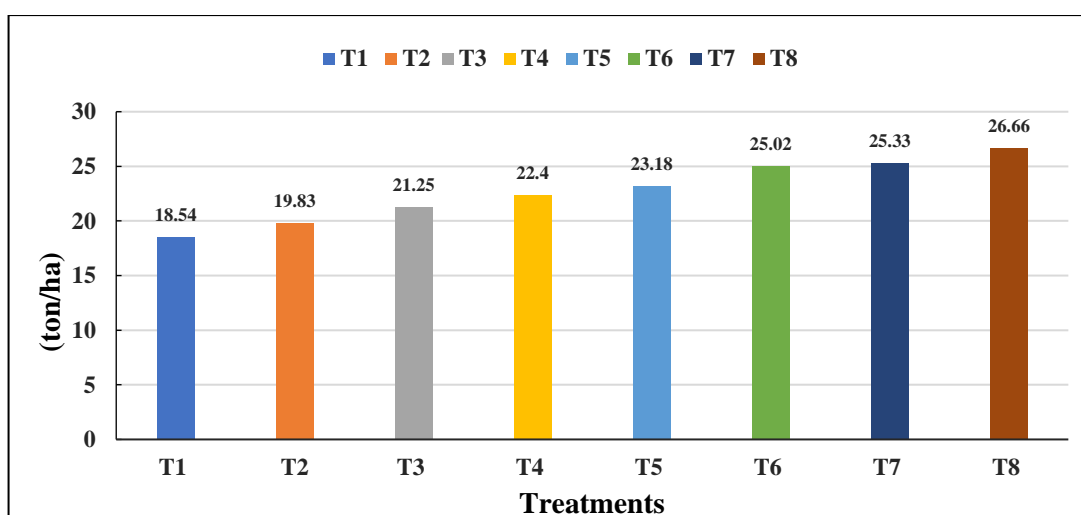
#### 3.2.1 Macronutrient uptake

A review of the mean data in Table 1 indicates that the total uptake of macronutrients (N, P and K) by the okra crop was significantly influenced by the foliar sprays of vermiwash. After harvesting, the uptake of nitrogen (N), phosphorus (P) and potassium (K) in okra was significantly enhanced by the application of different concentrations of vermiwash. The maximum nitrogen uptake was observed in T<sub>8</sub> with 76.83 kg ha<sup>-1</sup>, followed by T<sub>7</sub> with 75.34 kg ha<sup>-1</sup> and T<sub>6</sub> with 74.45 kg ha<sup>-1</sup>, which was at par with T<sub>5</sub> at 73.65 kg ha<sup>-1</sup>. The lowest N uptake was recorded in T<sub>1</sub> with 69.36 kg ha<sup>-1</sup>. Similarly, the highest phosphorus uptake was recorded in T<sub>8</sub> with 21.60 kg ha<sup>-1</sup>, followed by T<sub>7</sub> (19.77 kg ha<sup>-1</sup>) and T<sub>6</sub> (18.97 kg ha<sup>-1</sup>), which was at par with T<sub>5</sub> (18.40 kg ha<sup>-1</sup>). The lowest P uptake was also noted in T<sub>1</sub> with 14.81 kg ha<sup>-1</sup>. Potassium uptake followed a similar trend, with T<sub>8</sub> recording the highest uptake of 49.06 kg ha<sup>-1</sup>, followed by T<sub>7</sub> (48.42 kg ha<sup>-1</sup>) and T<sub>6</sub> (47.75 kg ha<sup>-1</sup>), which was at par with T<sub>5</sub> (47.34 kg ha<sup>-1</sup>). The lower K uptake was recorded in T<sub>1</sub> (43.99 kg ha<sup>-1</sup>) (Fig. 2). Foliar sprays of vermiwash significantly enhanced the uptake of nitrogen, phosphorus, and potassium in okra, with the highest uptake observed in the treatments with higher vermiwash concentrations. The control treatment consistently showed the lowest nutrient uptake. Similar findings were recorded by Tyagi et al. (2013) who reported significantly higher nutrient uptake in Green gram with the application of 100% RDF + vermicompost 1 t ha<sup>-1</sup> + Rhizobium.

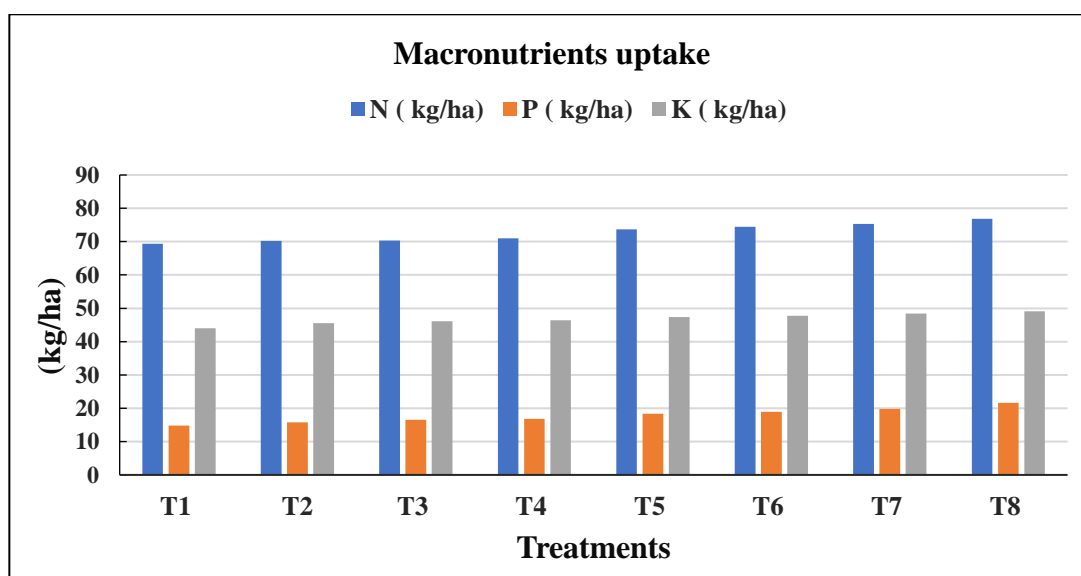
Joshi et al. (2023) also observed that uptake of straw increased with higher concentrations of nutrient ( $\text{kg ha}^{-1}$ ) of N, P and K by both seed and foliar spray of vermiwash.

**Table 1. Variation existed across the treatments regarding the fruit production of okra**

Treatments	Yield $\text{ton ha}^{-1}$	N ( $\text{kg ha}^{-1}$ )	P ( $\text{kg ha}^{-1}$ )	K ( $\text{kg ha}^{-1}$ )	Fe ( $\text{g ha}^{-1}$ )	Mn ( $\text{g ha}^{-1}$ )	Zn ( $\text{g ha}^{-1}$ )	Cu ( $\text{g ha}^{-1}$ )
T <sub>1</sub>	18.54	69.36	14.81	43.99	681.4	380.84	117.83	138.11
T <sub>2</sub>	19.83	70.26	15.80	45.52	729.9	402.89	133.19	165.80
T <sub>3</sub>	21.25	70.35	16.52	46.15	735.7	411.82	134.26	168.47
T <sub>4</sub>	22.40	70.97	16.78	46.42	750.1	413.60	135.21	177.73
T <sub>5</sub>	23.18	73.65	18.40	47.34	771.8	445.07	142.98	184.56
T <sub>6</sub>	25.02	74.45	18.97	47.75	788.0	452.96	144.32	192.39
T <sub>7</sub>	25.33	75.34	19.77	48.42	807.7	462.44	146.59	198.58
T <sub>8</sub>	26.66	76.83	21.60	49.06	819.1	479.12	153.63	203.45
<b>SE (m) ±</b>	<b>1.17</b>	<b>1.28</b>	<b>1.063</b>	<b>0.67</b>	<b>21.84</b>	<b>19.82</b>	<b>4.90</b>	<b>6.37</b>
<b>CD (0.05)</b>	<b>3.55</b>	<b>3.89</b>	<b>3.224</b>	<b>2.04</b>	<b>66.26</b>	<b>60.12</b>	<b>14.85</b>	<b>19.31</b>



**Fig. 1. Effect of vermiwash foliar sprays on yield of okra**



**Fig. 2. Effect of vermiwash foliar sprays on macronutrients uptake of okra**

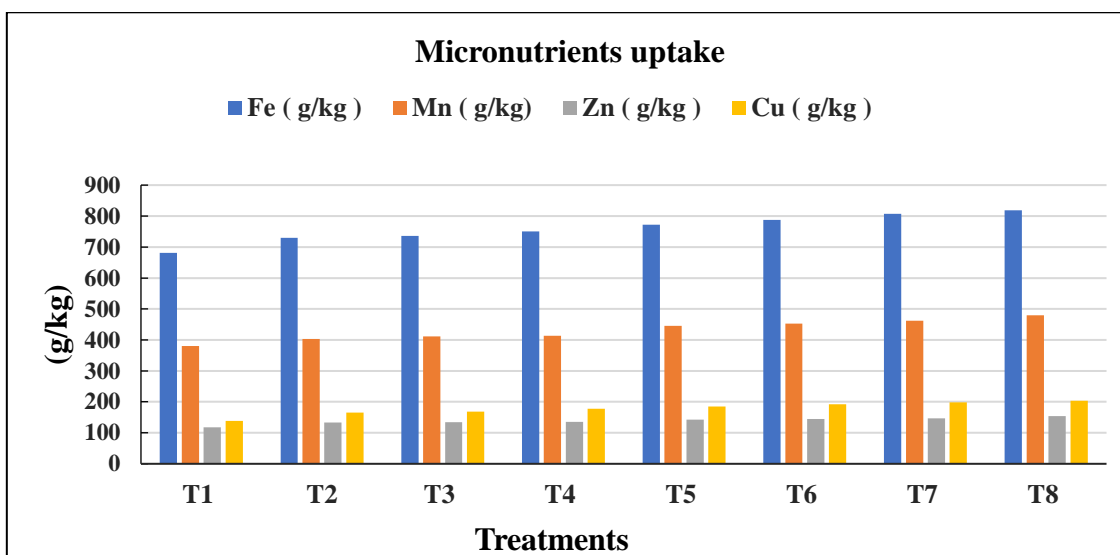


Fig. 3. Effect of vermiwash foliar sprays on macronutrients uptake of okra

### 3.2.2 Micronutrients uptake

The specific data on micronutrient uptake by the okra plant is given in Table 1. The significant uptake of Fe (819.1 g ha<sup>-1</sup>), Mn (479.12 g ha<sup>-1</sup>), Zn (153.63 g ha<sup>-1</sup>) and Cu (203.45 g ha<sup>-1</sup>) were recorded in treatment T<sub>8</sub> (100% GRDF + 30% Vermiwash spray) and least micronutrient uptake of Fe (681.4g ha<sup>-1</sup>), Mn (380.84g ha<sup>-1</sup>), Zn (117.83 g ha<sup>-1</sup>) and Cu (138.11 g ha<sup>-1</sup>) were observed in treatment T<sub>1</sub>(Fig. 3).

## 4. CONCLUSION

The study demonstrated that the application of vermiwash foliar sprays significantly improved the growth, yield and nutrient uptake in okra grown in Inceptisol soils. Among the treatments, the highest concentrations of vermiwash combined with GRDF (100% GRDF + 30% Vermiwash) consistently resulted in the highest fruit yield and enhanced uptake of both macronutrients (N, P and K) and micronutrients (Fe, Mn, Zn and Cu). The results suggest that vermiwash is an effective organic supplement that boosts nutrient availability, leading to better crop performance and higher productivity, with the potential to reduce the dependence on synthetic fertilizers.

### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

## COMPETING INTERESTS

Authors have declared that no competing interests exist

## REFERENCES

- Akanbi, W. B., Togun, A. O., Olaniran, O. A., & Akinfasoye, J. O. (2010). Influence of maize-stover compost and nitrogen fertilizer on growth, yield and nutrient uptake of okra (*Abelmoschus esculentus*). *Research Journal of Agronomy*, 4(3), 89-95.
- Ansari, A. A., & Sukhraj, K. (2010). Effect of vermiwash and vermicompost on soil parameters and productivity of okra (*Abelmoschus esculentus*) in Guyana. *African Journal of Agricultural Research*, 5(14), 1794-1798.
- Dwivedi, M., Patel, S., Dubey, A., Mishra, P. and Senguptal, S., K. (2018). Response of vermiwash, vermicompost and NPK on growth and yield of okra (*Abelmoschus esculentus* L.) cv. VRO 6. *International Journal of Chemical Studies* 6(3): 3001-3007.
- Farinde, A. J., Owolarafe, O. K., & Ogungbemi, I. O. (2007). An overview of production, processing, marketing and utilisation of okra in Egbedore Local Government Area of Osun State, Nigeria. *Agricultural Engineering International: CIGR Journal*, 9.
- Jackson, M. L. (1973). *Soil Chemical Analysis*, Prentice Hall of India Pvt.Ltd., New Delhi, 128,158 and 283.

- Joshi A. D, L. R. Yadav, Bhavna Singh Ratore, Hritik Srivastava, Ram Singh Verma, Biram Singh Gurjar, Mamta Yadav, Chetana Sharma and Anchal Karol (2023). Enhancing Nutrient Uptake and Economics of Black Gram through Vermicompost and Vermiwash Application. *International Journal of Environment and Climate Change*.
- Panse, V.G. and Sukhatme, P.V. (1985). *Statistical Methods for Agricultural Workers*, IV Edition. ICAR, New Delhi.
- Rao, S. S., & Rao, V. B. (2015). Response of okra (*Abelmoschus esculentus* L.) to nitrogen, phosphorus, and potassium fertilizers in alluvial soils of North-East India. *Journal of Plant Nutrition*, 38(9), 1402-1412.
- Singh, R. K., Pandey, P. C., & Verma, D. P. (2020). Role of organic amendments in sustainable vegetable production: A review. *Indian Journal of Horticulture*, 77(2), 139-149.
- Chapman, H.D. and Pratt, P.F. (1961) *Methods of analysis for soil, plant and water*. Division of Agricultural Science, California University, USA. 309.
- Tyagi, P.K. and Upadhyay, A.K. 2013. Effect of integrated nutrient management on yield, quality, nutrients uptake and economics of summer green gram. *Annals of Plant and Soil Research*.17(3): 242-247.
- Zoroski, R.J. and Burau, R.G. (1977). A rapid nitric perchloric acid digestion method for multi element tissue analysis. *Communication in Soil Sciences and Plant Analysis*.8(5), 425-436.

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:

<https://www.sdiarticle5.com/review-history/126237>