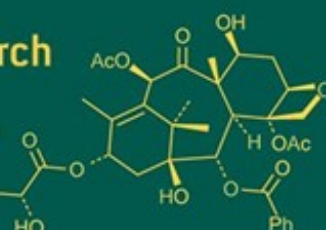


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Effect of seed priming and organic manures on growth attributes of okra [*Abelmoschus esculentus* (L.) Moench]

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ABSTRACT

The results of present investigation entitled “Effect of Seed Priming and Organic Manures on Growth, Yield and Quality of Okra [*Abelmoschus esculentus* (L.) Moench]” carried out during two consecutive years 2024-25 and 2025-26 at the open field of Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur during Zaid season in two consecutive years 2023-24 and 2024-25. The sixteen treatment combinations comprised of four level of seed priming (control, hydropriming, hormonal priming and biopriming) and four levels organic of organic manures (control, FYM @ 20t/ha, vermicompost @ 6t/ha, and poultry manure @ 3t/ha). These were evaluated on okra crop with three replications under a factorial randomized block design. Results showed that among seed priming treatment P_2 (hormonal priming) and under organic manures O_2 (vermicompost @ 6t/ha) and among 16 treatment combinations, treatment P_2O_2 (hormonal priming + vermicompost @ 6t/ha) was recorded superior in terms of different growth attributes of okra.

Keywords: Okra, Crop, Organic manures, Vermicompost, Seed priming, Sustainability

1. Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] is an important vegetable crop belonging to the family Malvaceae. It is an amphidiploid (allopolyploid) species with a somatic chromosome number of $2n = 130$ and is believed to have originated in tropical Africa. Commonly known as lady's finger, okra or gumbo, it is widely cultivated in tropical and subtropical regions owing to its adaptability, high yield potential and economic importance. Okra is highly valued for its nutritional and medicinal properties. The tender green fruits are rich in dietary fibre, vitamins A, C and K, minerals such as calcium and potassium and antioxidants. The seeds are a good source of edible oil and high-quality protein with a balanced composition of essential amino acids, particularly lysine and tryptophan. Owing to its vigorous growth, nutritional richness and multiple uses, okra has been described as “a perfect villager's vegetable” (Kumar *et al.*, 2010) [1]. Seed priming induces synchronized germination, improves seed vigour and promotes seedling growth under stressful conditions by increasing the rate and uniformity of germination and emergence (Bajehbaj, 2010) [2]. Organic manures such as farmyard manure, poultry manure and vermicompost are important sources of nutrients and organic matter for maintaining soil fertility. They supply a considerable proportion of macro and micronutrients and improve the physical, chemical and biological properties of soil. Organic manures also protect soil against erosion and help in conserving and improving its moisture holding capacity. The use of organic manures not only contributes to higher and sustainable crop yields but also enhances soil fertility and productivity (Sanwal *et al.*, 2007) [3].

2. Materials and Methods

The present investigation entitled “Effect of Seed Priming and Organic Manures on Growth, Yield and Quality of Okra [*Abelmoschus esculentus* (L.) Moench]” was carried out at Horticulture farm, Rajasthan College of Agriculture, MPUAT, Udaipur in open field condition and the chemical analysis was undertaken in the laboratory of the Department of Horticulture during Zaid 2023-2024 and 2024-25. The experiment statistical design is factorial RBD with total 16 treatment combination and 3 replications and 48 total no. of plots.

Treatments details

Factor A: Seed priming (P) – 04

1. P_0 – Control (The control group of seeds received no priming treatment)
2. P_1 – Hydropriming (The seeds were submerged in tap water for 12 hours)

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3. P₂ – Hormonal priming (The seeds were primed in a 200 ppm GA₃ solution for 12 hours)
4. P₃ – Biopriming (The seeds were primed with *Trichoderma viride* for 2 hours)

Factor B: Organic manures (O) – 04

1. O₀ – Control
2. O₁ – FYM @ 20t/ha
3. O₂ – Vermicompost @ 6t/h
4. O₃ – Poultry Manure @ 3t/ha

3. Results and Discussion

3.1 Effect of seed priming (P)

The effect of seed priming was recorded significant on growth attributes during both the years of investigation *i.e.* 2024-25, 2025-26 and in pooled analysis. As evident from the pooled data presented in Table 1, the highest pooled values of plant height (at 45 DAS *i.e.* 41.73 cm), number of branches plant⁻¹ (2.90 at 45 DAS), number of leaves plant⁻¹ (12.28 at 45 DAS) and number of nodes plant⁻¹ (18.88 at final harvest) were recorded under P₂ hormonal priming treatment (*i.e.* 200 ppm GA₃ solution for 12 hours), whereas, the minimum plant height (at 45 DAS *i.e.* 37.26 cm), number of branches plant⁻¹ (2.67 at 45 DAS), number of leaves plant⁻¹ (11.12 at 45 DAS) and number of nodes plant⁻¹ (16.82 at final harvest) were recorded under P₀ treatment (*i.e.* control). Growth attributes such as plant height, number of branches, number of leaves plant⁻¹ and number of nodes plant⁻¹ count showed remarkable enhancement due to hormonal priming (GA₃ @ 200 ppm). This improvement can be attributed to enhanced physiological and biochemical activities in seeds during early germination. Gibberellic acid (GA₃) plays a pivotal role in activating hydrolytic enzymes (such as α -amylase), which accelerate the mobilization of starch and reserve food materials to the embryonic axis, thereby promoting rapid cell division and elongation. These findings are in close conformity with the observations of Farooq *et al.* (2012) [4] and Hussain *et al.* (2015) [5], who reported that hormonal seed priming improves seedling vigor index, root-shoot development, and overall vegetative growth by regulating various metabolic pathways. Furthermore, Tahir *et al.* (2019) [6] also corroborated that GA₃ priming effectively enhances plant height and growth parameters in okra under varied soil conditions. Thejeshwini *et al.* (2019) [7] observed that seed priming with GA₃ @ 100 ppm for 6 hrs has showed better effect in improving all the growth characters over the control. These findings are also in agreement with results reported by Shah *et al.* (2011) [8] who stated that primed okra seeds gave higher number of branches per plant. This may be due to early emergence in primed seeds which resulted early growth and increase in number of branches.

3.2 Effect of organic manures (O)

The effect of organic manures was recorded significant on growth characters during both the years of investigation, *i.e.* 2024-25, 2025-26 and pooled analysis. The maximum pooled value of plant height (at 45 DAS *i.e.* 41.70 cm), number of branches plant⁻¹ (2.93 at 45

DAS), number of leaves plant⁻¹ (12.20 at 45 DAS) and number of nodes plant⁻¹ (18.47 at final harvest) were recorded under O₂ treatment (*i.e.* vermicompost @ 6t/ha), whereas, plant height (at 45 DAS *i.e.* 37.41 cm), number of branches plant⁻¹ (2.57 at 45 DAS), number of leaves plant⁻¹ (11.07 at 45 DAS) and number of nodes plant⁻¹ (17.26 at final harvest) were recorded under O₀ treatment (*i.e.* control). Application of organic manures significantly influenced the vegetative growth of okra, with vermicompost @ 6 t/ha (O₂) recording the maximum growth attributes compared to the control. The superior performance of vermicompost is primarily due to its rich nutrient profile, presence of humic substances, and beneficial microflora that collectively improve soil physical properties, porosity, and water-holding capacity. This ensures a steady and continued availability of both macro and micronutrients throughout the crop growth period. Similar results were recognized by Kumawat *et al.* (2019) [9] and Sharma *et al.* (2010) [10], who noted that vermicompost acts as an effective organic nutrient source that stimulates root explosion and enhances nutrient uptake. The balanced nutrient release pattern of vermicompost supports constant vegetative growth, leading to a higher number of leaves, branches, and nodes per plant.

3.3 Interaction effect of seed priming and organic manures

The combined application of hormonal priming (200 ppm GA₃ solution for 12 hours) along with organic manure (vermicompost @ 6t/ha) exhibited positive effect on plant height, number of branches plant⁻¹, number of leaves plant⁻¹ and number of nodes plant⁻¹. The maximum pooled value of plant height (at 45 DAS *i.e.* 43.51 cm), number of branches plant⁻¹ (3.10 at 45 DAS), number of leaves plant⁻¹ (12.57 at 45 DAS) and number of nodes plant⁻¹ (19.57 at final harvest) were recorded under P₂O₂ (hormonal priming + vermicompost @ 6t/ha), whereas the minimum was observed in control. This dual treatment demonstrated a pronounced synergistic interaction on the growth parameters of okra, which can be attributed to a dual-phase advantage where seed priming ensures uniform early emergence and rapid early-stage establishment, while vermicompost provides a continuous, balanced nutrient supply during later vegetative growth stages. Therefore, the optimized metabolic activity driven by GA₃ combined seamlessly with the improved soil rhizosphere and nutrient availability from vermicompost. These findings align well with the work of Ali *et al.* (2018) [11] and Chattopadhyay *et al.* (2021) [12], who emphasized that integrating seed priming techniques with integrated nutrient management (INM) maximizes resource-use efficiency, stimulates meristematic activity, and significantly boosts overall crop growth and development.

Conclusion

It can be concluded that seed priming treatments and organic manures significantly influenced the growth parameters of okra. Among individual treatments, hormonal priming with 200 ppm GA₃ (P₂) and vermicompost @ 6 t/ha (O₂) proved to be individually superior. Furthermore, the combined treatment P₂O₂ (hormonal priming along with vermicompost @ 6 t/ha) recorded maximum growth of okra. Therefore, integrating hormonal seed priming with vermicompost is highly recommended for maximizing the vegetative growth and sustainable production of okra under field conditions.

Table 1. Growth attributes of okra as influenced by different sources of seed priming and organic manure

Treatments	Plant height (cm)			Branches plant ⁻¹			Number of leaves plant ⁻¹			Number of nodes plant ⁻¹		
	At 45 DAS			At 45 DAS			At 45 DAS			At final harvest		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
A. Seed priming												
P ₀ – Control	37.12	37.40	37.26	2.63	2.70	2.67	11.08	11.15	11.12	16.78	16.85	16.82
P ₁ – Hydropriming	38.53	39.84	39.19	2.75	2.82	2.78	11.75	11.82	11.78	17.97	18.03	18.00
P ₂ – Hormonal priming	41.61	41.86	41.73	2.88	2.92	2.90	12.25	12.32	12.28	18.85	18.92	18.88

(continued on next page)

Treatments	Plant height (cm)			Branches plant ⁻¹			Number of leaves plant ⁻¹			Number of nodes plant ⁻¹		
	At 45 DAS			At 45 DAS			At 45 DAS			At final harvest		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
P ₃ – Bio priming	39.38	41.00	40.19	2.82	2.83	2.83	12.05	12.12	12.08	18.42	18.57	18.49
SEm ±	0.33	0.24	0.26	0.05	0.04	0.04	0.09	0.09	0.09	0.19	0.19	0.19
CD @ 5%	0.94	0.70	0.75	0.14	0.12	0.12	0.27	0.27	0.27	0.56	0.55	0.54
B. Organic Manure												
O ₀ – Control	36.94	37.88	37.41	2.53	2.60	2.57	11.03	11.10	11.07	17.22	17.30	17.26
O ₁ – FYM @20t/ha	38.58	39.75	39.17	2.78	2.82	2.80	11.95	12.02	11.98	18.23	18.30	18.27
O ₂ – Vermicompost @ 6t/ha	41.57	41.84	41.70	2.90	2.95	2.93	12.17	12.23	12.20	18.43	18.50	18.47
O ₃ – Poultry Manure @3t/ha	39.56	40.63	40.09	2.87	2.90	2.88	11.98	12.05	12.02	18.13	18.27	18.20
SEm ±	0.33	0.24	0.26	0.05	0.04	0.04	0.09	0.09	0.09	0.19	0.19	0.19
CD @ 5%	0.94	0.70	0.75	0.14	0.12	0.12	0.27	0.27	0.27	0.56	0.55	0.54

Table 2. Interaction effect of seed priming and organic manures on growth attributes of okra

Treatments	Plant height (cm)			Branches plant ⁻¹			Number of leaves plant ⁻¹			Number of nodes plant ⁻¹		
	At 45 DAS			At 45 DAS			At 45 DAS			At final harvest		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
P ₀ O ₀	36.37	36.75	36.56	2.60	2.67	2.63	10.80	10.87	10.83	16.60	16.73	16.67
P ₀ O ₁	36.49	37.01	36.75	2.60	2.67	2.63	11.00	11.07	11.03	16.80	16.87	16.83
P ₀ O ₂	38.62	38.52	38.57	2.67	2.73	2.70	11.47	11.53	11.50	16.87	16.93	16.90
P ₀ O ₃	36.99	37.33	37.16	2.67	2.73	2.70	11.07	11.13	11.10	16.87	16.87	16.87
P ₁ O ₀	36.17	37.66	36.92	2.67	2.73	2.70	10.47	10.53	10.50	18.07	18.13	18.10
P ₁ O ₁	37.41	39.27	38.34	2.67	2.73	2.70	12.13	12.20	12.17	17.93	18.00	17.97
P ₁ O ₂	42.24	42.25	42.24	2.87	2.93	2.90	12.27	12.33	12.30	18.07	18.13	18.10
P ₁ O ₃	38.31	40.18	39.25	2.80	2.87	2.83	12.13	12.20	12.17	17.80	17.87	17.83
P ₂ O ₀	38.53	38.63	38.58	2.47	2.53	2.50	11.73	11.80	11.77	17.53	17.60	17.57
P ₂ O ₁	41.94	42.02	41.98	2.93	2.93	2.93	12.27	12.33	12.30	19.00	19.07	19.03
P ₂ O ₂	43.14	43.87	43.51	3.07	3.13	3.10	12.53	12.60	12.57	19.53	19.60	19.57
P ₂ O ₃	42.82	42.91	42.87	3.07	3.07	3.07	12.47	12.53	12.50	19.33	19.40	19.37
P ₃ O ₀	36.68	38.47	37.58	2.40	2.47	2.43	11.13	11.20	11.17	16.67	16.73	16.70
P ₃ O ₁	38.47	40.72	39.60	2.93	2.93	2.93	12.40	12.47	12.43	19.20	19.27	19.23
P ₃ O ₂	42.27	42.71	42.49	3.00	3.00	3.00	12.40	12.47	12.43	19.27	19.33	19.30
P ₃ O ₃	40.10	42.09	41.10	2.93	2.93	2.93	12.27	12.33	12.30	18.53	18.93	18.73
S.E.m.±	0.65	0.48	0.52	0.09	0.08	0.08	0.19	0.19	0.18	0.39	0.38	0.37
C.D.0.05%	1.88	1.40	1.49	0.27	0.24	0.24	0.54	0.54	0.53	1.12	1.11	1.08

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