International Journal of Advanced Biochemistry Research 2025; SP-9(9): 374-378

International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(9): 374-378
www.biochemjournal.com
Received: 10-07-2025
Accepted: 15-08-2025

All authors details below the references

Corresponding Author:
Kamble VB
M.Sc. Scholar, Department of Soil Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

The effect of different fertilizer levels on the vegetative and reproductive growth of mango cv. Kesar

Kamble VB, Puri AN, Adsul PB, Shinde VN, Waghmare MS, Gajbhiye BR, Ugile SK, Ghorband VK, and Pralipta Swain

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i9Se.5525

Abstract

The present investigation, entitled "The effect of different fertilizer levels on the vegetative and reproductive growth of mango cv. Kesar" was conducted on a 10-year-old, well-established mango orchard at the Department of Horticulture, College of Agriculture, Latur, VNMKV, Parbhani, during the year 2024-25. The experiment was carried out using a factorial randomized block design with two factors and three replications. The first factor was fertilizer dose (D_1: 1000 g N, 500 g P, and 500 g K tree^{-1}, D_2: 1500 g N, 500 g P, and 750 g K tree^{-1}, D_3: 2000 g N, 500 g P, and 1000 g K tree^{-1}). The second factor was time of application of fertilizer dose on (M_1: 50% of N and 100% of P, K in June and 50% of N in August, M_2: 50% of N, K and 100% of P in June and 50% of N and 50% of K in August, M_3: 50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November). The treatments were applied as per the experimental plan, and observations were recorded on vegetative and reproductive growth parameters.

The results revealed that the application of a fertilizer dose of 2000 g N, 500 g P, and 1000 g K tree^{-1} recorded the best performance. This treatment resulted in the maximum shoot length (12.25 cm), internodal length (2.71 cm), number of panicles tree^{-1} (606.77) and length of panicles (31.63 cm). The treatment with time of fertilizer application, the schedule of applying 50% of N and 100% of P in June, followed by 50% of N and 50% of K in August, and 50% of K in November, resulted in the maximum shoot length (11.98 cm), internodal length (2.53 cm), number of panicles tree^{-1} (618.68) and length of panicles (34.69 cm). However, the interaction effect of fertilizer dose and time of application showed no significant effect on vegetative and reproductive growth parameters.

Keywords: Mango, Kesar, fertilizer, growth

Introduction

Mango (*Mangifera indica* L.), known as the "king of fruits" in India, originated in South-East Asia and is valued for its drought resistance and profitability in dryland areas. The Kesar variety from Maharashtra's Marathwada region is renowned for its high total soluble solids (up to 24° Brix), giving it exceptional sweetness, flavour, and nutritional quality. Latur district, with about 15% of Marathwada's Kesar mango area, enjoys ideal conditions for premium fruit production, playing a key role in the region's mango economy.

Nitrogen (N) is essential for vegetative growth, imparting green colour to plants and contributing to the synthesis of proteins, nucleic acids (RNA), and chlorophyll. Phosphorus (P) plays a crucial role in energy storage and transfer during photosynthesis and respiration, primarily as ADP and ATP, the "energy currency" of plants. It is also vital for seed and fruit development, flower initiation, and root growth. Potassium (K) enhances crop quality, reduces disease incidence, and is required for protein synthesis, sugar transport, photosynthesis, and enzyme activation.

Soil health is vital for sustaining biodiversity, productivity, and mango yields. Mango trees heavily deplete soil nutrients, and without timely replenishment especially potassium fertility and fruit quality decline. Uneven or insufficient fertilization and the crop's biennial bearing pattern make nutrient management challenging. Stage-specific, balanced, and timely fertilizer application within the root zone, aligned with mango's growth phases, is essential for maintaining soil fertility, improving quality, and achieving sustainable high yields.

Mango cultivation in the Latur district occurs in soils with varying depth, texture, calcareousness, and nutrient availability.

In recent years, local mango producers have successfully exported their produce to external markets, highlighting the region's potential for high-quality production. However, optimizing fertilizer management is crucial to enhance yields, address nutrient deficiencies, and improve fruit quality.

Materials and Methods

The present study entitled, "The effect of different fertilizer levels on the vegetative and reproductive growth of mango cv. Kesar," was conducted in an experimental cum research mango orchard, Department of Horticulture, College of Agriculture, Latur, VNMKV, Parbhani, during the year 2024-25. The experiment was carried out using a factorial randomized block design with two factors: the first factor was fertilizer dose (D1-1000 g N tree^{-1}, 500 g P tree^{-1}, 500 g tree^{-1}), (D2-1500 g N tree^{-1}, 500 g P tree^{-1}, 750 g tree^{-1}) and (D3-2000 g N tree^{-1}, 500 g P tree^{-1}, 1000 g tree^{-1}), and the second factor was the time of application of fertilizer dose (M1-50% of N and 100% of P, K in June and 50% of N in August), (M2-50% of N K and 100% of P in June and 50% of N and 50% of K in August) and (M3-50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November). The experiment had three replications. The treatment combinations were soil application of fertilizers at T_1-[(N 1000 g tree^{-1} + P 500 g tree^{-1} + K 500 g tree^{-1}) and its application is 50% of N and 100% of P, K in June and 50% of N in August.], T_2-[(N 1000 g tree^{-1} + P 500 g tree^{-1} + K 500 g tree^{-1}) and its application is 50% of N, K and 100% of P in June and 50% of N and 50% of K in August.] T_3-[(N 1000 g tree^{-1} + P 500 g tree^{-1} + K 500 g tree^{-1}) and its application is 50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November], T_4-[(N 1500 g tree^{-1} + P 500 g tree^{-1} + K 750 g tree^{-1}) and its application is 50% of N and 100% of P, K in June and 50% of N in August], T_5-[(N 1500 g tree^{-1} + P 500 g tree^{-1} + K 750 g tree^{-1}) and its application is 50% of N, K and 100% of P in June and 50% of N and 50% of K in August], T_6-[(N 1500 g tree^{-1} + P 500 g tree^{-1} + K 750 g tree^{-1}) and its application is 50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November], T_7-[(N 2000 g tree^{-1} + P 500 g tree^{-1} + K 1000 g tree^{-1}) and its application is 50% of N and 100% of P, K in June and 50% of N in August.], T_8-[(N 2000 g tree^{-1} + P 500 g tree^{-1} + K 1000 g tree^{-1}) and its application is 50% of N K and 100% of P in June and 50% of N and 50% of K in August] and T_9-[(N 2000 g tree^{-1} + P 500 g tree^{-1} + K 1000 g tree^{-1}) and its application is 50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November]. Observations were taken for shoot length, internodal length, days of panicle emergence, and the number of panicles tree^{-1}, Length of panicle which were manually counted and documented.

Results and Discussion

Shoot Length (cm)

Effect of dose (D)

The effect of different levels of fertilizer on shoot length was found to be significant. The maximum shoot length recorded (12.25 cm) under D3 (2000 g N, 500 g P, and 1000 g K tree^{-1}) was followed by (11.34 cm) with the dose of fertilizer D2 (1500 g N, 500 g P, and 750 g K tree^{-1}). While D1 (1000 g N, 500 g P, and 500 g K tree^{-1}) registered the minimum shoot length (10.58 cm).

Nitrogen, phosphorus, and potassium collectively enhance shoot elongation—N supports amino acid and chlorophyll synthesis, P aids root growth and energy transfer, and K improves water uptake and enzyme activity. Full-dose NPK treatments boost physiological processes, leading to stronger shoots that benefit canopy development, productivity, and future flowering. These findings agree with Fouad *et al*. (2003) [1] who reported that balanced, full-dose NPK improves vegetative growth in mango.

Effect of time (M)

The data revealed that the variation in shoot length was found to be significant. The shoot length of mango was significantly increased by different time of fertilizer application. Maximum shoot length (11.98 cm) was noted at application of fertilizer M3 (50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November) followed by (11.72 cm) with M2 (50% of N, K and 100% of P in June and 50% of N and 50% of K in August) and minimum shoot length (10.47 cm) was recorded at the M1 (50% of N and 100% of P, K in June and 50% of N in August).

Similar findings were reported by Makhmale (2017), who studied the effect of fertigation on growth, flowering, yield, and quality of Kesar mango under an ultra-high density planting (UHDP) system. He observed that applying 180:120:150 g N:P:K tree^{-1} significantly increased shoot length.

Interaction Effect (DxM)

The interaction effect of dose and time of fertilizer application on shoot length was found to be non-significant.

Internodal Length

Effect of dose (D)

The effect of different doses of fertilizer on internode length was found to be significant. The maximum internode length (2.71 cm) was recorded with the fertilizer dose D3 (2000 g N, 500 g P, and 1000 g K tree^{-1}), followed by (2.30 cm) with dose D2 (1500 g N, 500 g P, and 750 g K tree^{-1}). The minimum internode length (2.09 cm) was recorded with dose D1 (1000 g N, 500 g P, and 500 g K tree^{-1}).

Phosphorus supports energy transfer and root development for improved nutrient uptake, potassium regulates water balance, activates enzymes, and maintains physiological stability, while nitrogen, essential for amino acids and chlorophyll, promotes vegetative growth and internode expansion. Together, these nutrients enhance cell enlargement and stem elongation, leading to increased internodal length. These results align with Fouad *et al*. (2003) [1], who reported greater internodal length in mango with higher K rates and split applications alongside recommended N and P, and with Yadav *et al*. (2017) [3], who found that balanced NPK fertilization improved internodal elongation, enhancing canopy structure and light penetration.

Effect of time (M)

Perusal of data revealed significant variations in intermodal length over different times. The maximum internodal length (2.53 cm) was observed with the fertilizer application schedule M3 (50% of N and 100% of P in June, 50% of N and 50% of K in August, and 50% of K in November), followed by (2.39) cm under M2 (50% of N and K, and

100% of P in June, and 50% of N and K in August). The minimum internodal length (2.18 cm) was recorded with M1 (50% of N and 100% of P and K in June, and 50% of N in August).

The sustained nutrient supply, especially nitrogen, vital for cell division and protein synthesis, appears to contribute to increased internodal length. Continuous application of NPK over multiple growing seasons significantly enhanced internodal elongation in mango shoots compared to trees receiving irregular or no fertilization. These results align with Fouad *et al*. (2003) [1] and Jatav *et al*. (2019) [4], who also reported that consistent fertilization improved internodal spacing, leading to a more open and efficient canopy structure.

Interaction Effect (DxM)

The interaction effect of dose and time of fertilizer application on internodal length was found to be non-significant.

Days of panicle emergence

Effect of dose (D)

The effect of different doses of fertilizer application on days of panicle emergence was found to be significant. The days of panicle emergence of mango were significantly reduced by fertilizer application; however, the effect was more pronounced in the higher concentrations than in the lower concentrations. The minimum number of days to panicle emergence (46.89) was recorded with the fertilizer dose D3 (2000 g N, 500 g P, and 1000 g K tree^{-1}), followed by 52.73 days with dose D2 (1500 g N, 500 g P, and 750 g K tree^{-1}). The maximum days to panicle emergence (53.75) were observed with dose D1 (1000 g N, 500 g P, and 500 g K tree^{-1}).

The shortest flowering-to-fruit-set period was observed in treatment D3, likely due to a high C:N ratio that promoted early flowering and bearing (Katyal & Dutta, 1971; Madhumathi *et al*., 2004) [5, 6]. Ogendo *et al*. (2008) [7] also reported that higher phosphorus doses enhanced photosynthetic production, breaking bud dormancy and increasing flowering sites, with similar findings in mango by Das *et al*. (2008) [8]. Likewise, Rani and Babu (2016) [9] noted that full NPK application advanced mango reproductive phenology, significantly reducing days to panicle emergence.

Effect of time (M)

The variation in days to panicle emergence was significantly affected by the timing of fertilizer application. The shortest period (46.63 days) was recorded under schedule M3 (50% N and 100% P in June, 50% N and 50% K in August, and 50% K in November), while the longest period (54.77 days) was observed with schedule M1 (50% N and 100% P and K in June, and 50% N in August).

Applying fertilizers in August replenishes nutrient reserves after harvest and promotes new vegetative flushes, while the November application aligns with floral induction and differentiation in mango. Balanced N, P, and K supply during these periods enhances metabolic activity, stimulates floral hormone synthesis, and supports carbohydrate accumulation key factors for timely floral bud initiation. These results agree with Patel *et al*. (2018) [11] reported that post-monsoon NPK application in cv. Kesar reduced days to flowering through improved nutrient assimilation and physiological readiness.

Interaction Effect (DxM)

The interaction effect of dose and time of fertilizer application on days of panicle emergence was found to be non-significant.

Number of panicle tree^{-1}

Effect of dose (D)

The number of panicles tree^{-1} was significantly influenced by fertilizer dose. While fertilizer application reduced the days to panicle emergence, the effect was more pronounced at higher doses. The highest number of panicles (606.77) was recorded with dose D3 (2000 g N, 500 g P, and 1000 g K tree^{-1}), followed by 575.08 with dose D2 (1500 g N, 500 g P, and 750 g K tree^{-1}). The lowest count (520.86) was observed with dose D1 (1000 g N, 500 g P, and 500 g K tree^{-1}).

Macronutrients play a key role in enhancing plant vigour, floral bud differentiation, and flowering potential, thereby increasing the number of panicles. Nitrogen supports vegetative and shoot growth, phosphorus aids energy transfer and floral development, and potassium is vital for enzyme activation, water regulation, and carbohydrate transport needed for bud initiation and blooming. These results agree with Fouad *et al*. (2003) [1], who found that higher K levels with balanced N and P significantly increased panicle numbers in mango. Similarly, Reddy *et al*. (2017) [10] reported that elevated NPK levels boosted floral intensity, leading to more inflorescences.

Effect of time (M)

The number of panicles tree^{-1} was significantly affected by the timing of fertilizer application. The highest count (618.68) was obtained with schedule M3 (50% N and 100% P in June, 50% N and 50% K in August, and 50% K in November), followed by (552.85) with M2 (50% N and K, and 100% P in June, 50% N and 50% K in August). The lowest number (531.18) was recorded with M1 (50% N and 100% P and K in June, and 50% N in August).

The higher panicle production with continuous fertilizer application may be attributed to the consistent supply of essential nutrients at different phenological stages, ensuring optimal plant nutrition throughout the growth cycle. Potassium regulates water use and enhances stress tolerance key factors for initiating and sustaining reproductive growth, while nitrogen promotes vegetative shoot growth and phosphorus supports energy metabolism and root health. These results align with Fouad *et al*. (2003) [1], Singh *et al*. (2016) [12] and Patel *et al*. (2018) [11].

Interaction Effect (DxM)

The interaction effect of dose and time of fertilizer application on the number of panicles tree^{-1} was found to be non-significant.

Length of panicle (cm)

Effect of dose (D)

Panicle length in mango was significantly influenced by fertilizer dose, with higher concentrations showing a greater effect. The longest panicles (31.63 cm) were recorded with dose D3 (2000 g N, 500 g P, and 1000 g K tree^{-1}), followed by (29.47) cm with dose D2 (1500 g N, 500 g P, and 750 g K tree^{-1}). The shortest panicles (27.99 cm) were observed with dose D1 (1000 g N, 500 g P, and 500 g K tree^{-1}).

These results are in agreement with Fouad *et al*. (2003) [1] and Reddy *et al*. (2017) [10]. Singroul (2016) [13] also observed significantly maximum panicle length under the treatment receiving 100 percent fertilizer dose in mango cv. Amarpali.

Effect of time (M)

Panicle length was significantly affected by the timing of fertilizer application. The longest panicles (34.69 cm) were recorded with schedule M3 (50% N and 100% P in June, 50% N and 50% K in August, and 50% K in November), followed by 27.88 cm with M2 (50% N and K, and 100% P in June, 50% N and 50% K in August). The shortest panicles (26.52 cm) were observed with M1 (50% N and 100% P and K in June, and 50% N in August).

This observation is in agreement with the earlier findings of fertilizer influence on the length of panicle by Singroul (2016) [13], Fouad *et al*. (2003) [1] and Patel *et al*. (2018) [11].

Interaction Effect (DxM)

The interaction effect of dose and time of fertilizer application on the length of panicle tree^{-1} was found to be non-significant.

Table 1: Effect of dose and time of application of fertilizer on shoot length and internodal length of mango Cv. Kesar

Treatments	Shoot length (cm)	Internodal length (cm)
Fertilizer Doses		
D1	10.58	2.09
D2	11.34	2.30
D3	12.25	2.71
SE±	0.14	0.15
C. D. at 5%	0.44	0.45
Time of application		
M1	10.47	2.18
M2	11.72	2.39
M3	11.98	2.53
SE±	0.14	0.15
C. D. at 5%	0.44	0.45
Interaction (D×M)		
D1M1	10.04	2.00
D1M2	10.94	2.07
D1M3	10.77	2.19
D2M1	10.33	2.21
D2M2	11.85	2.30
D2M3	11.85	2.40
D3M1	11.05	2.33
D3M2	12.36	2.81
D3M3	13.33	3.00
SE±	0.26	0.27
C. D. at 5%	NS	NS
General Mean	11.39	2.37

Treatment Details

D	N (g tree^{-1})	P (g tree^{-1})	K (g tree^{-1})
D_1	1000	500	500
D_2	1500	500	750
D_3	2000	500	1000

M_1	50% of N and 100% of P, K in June and 50% of N in August.
M_2	50% of NK and 100% of P in June and 50% of N and 50% of K in of August.
M_3	50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November.

Table 2: Effect of dose and time of application of fertilizers on Days of panicle emergence, Number of panicle tree^{-1} and Length of panicle (cm)

Treatments	Days of panicle emergence	Number of panicle tree^{-1}	Length of panicle (cm)
Fertilizer Doses			
D1	53.75	520.86	27.99
D2	52.73	575.08	29.47
D3	46.89	606.77	31.63
SE±	1.08	18.4	0.81
C. D. at 5%	3.25	55.4	2.4
Time of application			
M1	54.77	531.18	26.52
M2	51.97	552.85	27.88
M3	46.63	618.68	34.69
SE±	1.08	18.4	0.81
C. D. at 5%	3.25	55.4	2.4
Interaction (D×M)			
D1M1	56.45	484.02	26.59
D1M2	56.67	522.71	27.66
D1M3	48.13	541.65	29.73
D2M1	58.95	522.96	25.46
D2M2	52.53	536.92	26.92
D2M3	46.70	634.83	36.01
D3M1	48.91	586.56	27.51
D3M2	46.70	598.93	29.05
D3M3	45.04	679.56	38.32
SE±	1.88	32.04	1.42
C. D. at 5%	NS	NS	NS
General Mean	51.12	567.57	29.69

Treatment Details

D	N (g tree^{-1})	P (g tree^{-1})	K (g tree^{-1})
D_1	1000	500	500
D_2	1500	500	750
D_3	2000	500	1000

M_1	50% of N and 100% of P, K in June and 50% of N in August.
M_2	50% of NK and 100% of P in June and 50% of N and 50% of K in of August.
M_3	50% of N and 100% of P in June and 50% of N, 50% of K in August and 50% of K in November.

Conclusion

The present investigation, based on the effect of different fertilizer levels on the vegetative and reproductive growth of mango cv. Kesar led to the following conclusions: The treatment with a fertilizer dose of 2000 g N, 500 g P, and 1000 g K tree^{-1} had a significant positive impact on vegetative parameters and flower parameters of mango. The treatment with time of fertilizer application, the schedule of applying 50% of N and 100% of P in June, followed by 50% of N and 50% of K in August, and 50% of K in November, showed a significantly better impact on vegetative growth, flowering parameters of the mango. The interaction between the two factors revealed that the fertilizer treatment of 2000 g N, 500 g P, and 1000 g K tree^{-1}, combined with the application schedule of 50% N and 100% P in June, 50% N and 50% K in August, and 50% K in November, was the most effective in enhancing the vegetative growth, flowering parameters of the mango.

References

1. Fouad AS, El-Migeed AA, El-Sayed AB, Haggag LF. Response of mango trees (cv. Mabrouka) to potassium

fertilization and number of application times. Ann Agric Sci Ain Shams Univ. 2003;48(2):747-760.
2. Makhmale S, Makwana AN, Kore P, Barad AV. Effect of different fertigation treatments on yield and quality of mango cv. Kesar raised under ultra-high-density planting (UHDP) system. Int J Farm Sci. 2017;6(4):1-7.
3. Yadav RK, Kumar P, Sharma HG. Effect of nutrient management on vegetative growth parameters of mango (*Mangifera indica* L.) cv. Amrapali. J Pharmacogn Phytochem. 2017;6(6):1328-1331.
4. Jatav MK, Jain PK, Sharma R. Effect of nutrient management on vegetative growth and flowering of mango (*Mangifera indica* L.). Int J Chem Stud. 2019;7(3):2099-2102.
5. Katyal SL, Dutta CP. Irregular bearing in mango and remedial measures. Andhra Agric J. 1971;18(2):237-241.
6. Madhumathi C, Sadarunnisa S, Purushottam K. Fertigation studies in Robusta banana. In: Proceedings of National Seminar on Banana Industry: Present Scenario and Future Strategies; BCKV, Kalyani, West Bengal. 2004. p. 120-124.
7. Ogendo RO, Isutsa DK, Singunga DO. Interaction of farm yard manure and plant population density effects on soil characteristics and productivity of mulched strawberry in a tropical climate. Afr J Hortic Sci. 2008;1(11):100-115.
8. Das A, Mandal KK, Hasan MA, Bhattacharya B, Majumdar D, Bandopadhyay B. Effect of organic and inorganic nutrients on improving flowering of mango. Acta Hortic. 2009;820:371-380.
9. Rani R, Babu KD. Effect of NPK on flowering and fruiting behavior of mango (*Mangifera indica* L.). J Hortic Sci. 2016;11(1):42-46.
10. Reddy YTN, Kurian RM, Singh G. Role of NPK and micronutrients in flowering and fruiting of mango (*Mangifera indica* L.). Indian J Hortic. 2017;74(3):358-362.
11. Patel DM, Patel JC, Chaudhari ML. Effect of NPK application time on flowering and yield of mango cv. Kesar. Int J Chem Stud. 2018;6(2):250-253.
12. Singh R, Dhaliwal SS, Brar BS. Effect of nitrogen management on nutrient dynamics in soil and uptake by mango (*Mangifera indica* L.). Indian J Hortic. 2016;73(2):179-184.
13. Singroul S. Effect of macro and micro-nutrients on flowering, fruiting yield and quality of mango cv. Amrapali [MSc thesis]. Jabalpur: Jawaharlal Nehru Krishi Vishwa Vidyalay; 2016.

Authors Details

Kamble VB
MSc Scholar, Department of Soil Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Puri AN
Assistant Professor, Department of Soil Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Adsul PB
Associate Professor, Department of Soil Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Shinde VN
Associate Professor, Department of Horticulture, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Waghmare MS
Assistant Professor, Department of Soil Science, College of Agriculture, Dharashiv, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Gajbhiye BR
Associate Professor, Department of Soil Science, College of Agriculture, Parbhani, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Ugile SK
Associate Professor, Department of Soil Science, College of Agriculture, Badnapur Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Ghorband VK
MSc Scholar, Department of Soil Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Pralipta Swain
MSc Scholar, Department of Soil Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India