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Effect of spacing and trailing system on growth and yield of Indian spinach (*Basella alba* L.)

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Abstract
The present investigation entitled "Effect of spacing and trailing system on growth and yield of Indian spinach (*Basella alba* L.)" was conducted at the College of Horticulture, Dapoli, Dist. Ratnagiri (M.S.) during the academic year 2024-25. The experiment was carried out in a factorial randomized block design (FRBD), with two factors, nine treatment combinations and three replications. Among two factors: factor A, spacings (S_1- 45 cm x 30 cm, S_2- 30 cm x 30 cm and S_3- 15 cm x 30 cm) and factor B, trailing systems (T_1: Ground trailing, T_2: No trailing (harvesting of new sprouts) and T_3: Trailing on low bower). Among spacings, S_1 (45 cm x 30 cm) demonstrated superior performance in growth parameters such as vine length (73.00 cm) and number of nodes (21.49), whereas spacing S_2 (30 cm x 30 cm) recorded the highest number of branches (1.80) and yield parameters like total herbage yield per plant (190.96 g). The highest number of leaves (64.67) and yield parameters *viz.* total number of harvests (13.78), total herbage yield per plot (21.85 kg), total herbage yield (22.58 t/ha) were observed in closer spacing S_3 (15 cm x 30 cm). Among trailing systems, T_3 (trailing on low bower) recorded the highest vine length (73.56 cm), number of leaves (62.67), number of branches (1.51), number of nodes (20.80), yield parameters like total herbage yield per plant (201.56 g), total herbage yield per plot (13.96 kg), total herbage yield (14.40 t/ha). Treatment T_3 was better than T_1 and T_2 in terms of growth and yield characteristics. In interaction, wider spacing (45 cm x 30 cm) with trailing on low bower was superior in growth parameters, whereas overall yield was greater in closer spacing of 15 cm x 30 cm with trailing on low bower. The data recorded in the present investigation revealed that spacing and trailing systems influenced the growth and yield parameters of Indian spinach. Thus, considering the yield of Indian spinach, a spacing of 15 cm x 30 cm with trailing on a low bower was found to be beneficial under Konkan conditions.

Keywords: Indian spinach, spacing, trailing system, growth, yield

Introduction
Basella (*Basella spp*.), belonging to the family basellaceae, is a fast-growing viny vegetable native to tropical Asia, specifically India or Indonesia (Grubben & Denton, 2004) [10]. It is highly heat-tolerant and is commonly known by several names, including Malabar spinach, Ceylon spinach, East Indian spinach, Surinam spinach and Chinese spinach (Facciola, 1990) [8]. It is found abundant in Malaysia, Philippines, tropical Africa, Caribbean islands, tropical South America and southeastern Brazil (Anonymous, 2006) [5]. Due to its ability to adapt easily to various soil types and climatic conditions, basella is considered one of the best tropical leafy vegetables worldwide (Palada & Crossman, 1999) [19]. In the Philippines, it is a key ingredient in *utan*, a vegetable dish cooked with sardines, onions, garlic and parsley. In Mangalorean Tuluva cuisine, a coconut-based gravy called *gassi* is paired with the basella plant to create a delicacy known as *Basale gassi*, traditionally enjoyed with rice dumplings called *pundi*, which are soaked overnight in the gravy or served with red rice. Carl Linnaeus identified two species of basella: *Basella rubra* L. and *Basella alba* L. *Basella alba* is the green-stemmed species, while *Basella rubra* has red stalks and a slightly reddish-purple tint on the undersides of its leaves (Deshmukh, 2014) [7]. Basella is a perennial vine with fibrous roots. Its stem is fleshy, succulent, thin, smooth and bright, with leaves arranged in a spiral pattern. The stem also exhibits side branching and can grow to a length of approximately 8 to 10 meters if left unpruned. The leaf stalk is short and the leaves are oblong in shape. The flowers of basella vary in colour, appearing white, red or pink depending on the variety.

Its fruits are either dark red or black. The seeds have a bright, rough surface and are black or brown in colour, encased in a thick testa. Under optimal conditions, the seeds can remain viable for up to four years (Almeida, 2003; Mahr, 2014) [4, 16].

Material and Methods

The experiment was conducted at the College of Horticulture, Dapoli, Dist.-Ratnagiri, during the year 2024. Geologically, Dapoli is located in a subtropical region with 17°45 N Latitude and 73°12' E Longitude. The experimental plot was laid out in Factorial Randomized Block Design (FRBD) with nine treatment combinations and three replications. The experiment consisted of two factors: factor A, spacings (S_1- 45 cm x 30 cm, S_2- 30 cm x 30 cm and S_3- 15 cm x 30 cm) and factor B, trailing systems (T_1: Ground trailing, T_2: No trailing (harvesting of new sprouts) and T_3: Trailing on low bower). Well-matured cuttings of the local basella type were collected from healthy, disease-free and mature vines. The planting was done on different spacing as per the treatment, *i.e*., 45 cm x 30 cm, which accommodated 45 plants; 30 cm x 30 cm accommodated 69 plants; and 15 cm x 30 cm accommodated 138 plants in each plot of 7 m x 1 m. There were a total of 2268 plants in the experimental area of 414 sq. m. An area of 18 m x 23 m was divided into three equal blocks. Each block was divided into nine plots and nine treatments were allotted randomly. There were 27-unit plots and the size of each unit plot was 7 m x 1 m. The distance maintained between blocks and replications was 1.0 m and 1.0 m, respectively. Five plants per treatment per replication were selected randomly and observations were recorded on different growth parameters and yield parameters. Observations like vine length (cm), number of leaves, number of branches and number of nodes were recorded every month, counted in all selected plants and the average of five plants was computed. Whereas the total number of harvests, total herbage yield per plant (g), total herbage yield per plot (kg) and total herbage yield (t/ha) were taken as averages from 60 to 210 DAP.

Treatment combination	Treatment details
S_1T_1	45 cm x 30 cm spacing with ground trailing
S_1T_2	45 cm x 30 cm spacing with no trailing
S_1T_3	45 cm x 30 cm spacing with trailing on low bower
S_2T_1	30 cm x 30 cm spacing with ground trailing
S_2T_2	30 cm x 30 cm spacing with no trailing
S_2T_3	30 cm x 30 cm spacing with trailing on low bower
S_3T_1	15 cm x 30 cm spacing with ground trailing
S_3T_2	15 cm x 30 cm spacing with no trailing
S_3T_3	15 cm x 30 cm spacing with trailing on low bower

Result and Discussion

Effect of spacing (S)

Growth parameters: The different spacings had significant effect on vine length (cm), number of leaves, number of branches and number of nodes as shown in Table 1 (a) and (b). At 210 DAP, planting at S_1 (45 cm x 30 cm) registered the significantly highest vine length (73.00 cm), whereas the lowest (63.00 cm) was recorded in treatment S_3 (15 cm x 30 cm). vine length was found to be decreasing with a reduction in spacing, the higher plant population per unit area led to increased competition for light, nutrients and space, resulting in the production of fewer vines under closer spacing compared to wider spacing. Planting at S_3 (15 cm x 30 cm) observed the significantly greatest number of leaves (64.67) due to high-density planting, which encouraged rapid and dense foliage, whereas the least number of leaves (56.67) was recorded in treatment S_1 (45 cm x 30 cm) as the wider spacing allowed the plants to focus on quality over quantity, producing fewer but potentially larger leaves due to reduced competition and better access to resources. The similar results were also recorded by Islam *et al.* (2014) [13] as well as Pawar *et al*. (2021) [21] in Indian spinach (*Basella rubra* L.) and Rahman *et al*. (2007) [22] in amaranth (*Amaranthus lividus* L.). At 180 DAP, the higher number of nodes (21.49) was observed in S_1 (45 cm x 30 cm) as it allowed each plant to fully express its growth potential, especially as the crop matured, leading to more nodes, whereas the lower number of nodes (16.89) was recorded in S_3 (15 cm x 30 cm) may be due to more competition among the plants, which led to stunted growth. The similar results were also recorded by Sarkar et al. (2014) in water spinach (*Ipomoea reptans* Poir.) and Adeyeye *et al*. (2017) in sweet melon. At 120 DAP, treatment S_2 (30 cm x 30 cm) recorded a significantly higher number of branches (1.80) which generally supported better branching during the mid-growth phase (90-150 DAP) due to its balanced plant density, whereas the lowest number of branches (1.20) was observed in S_3 (15 cm x 30 cm) often limited branching due to overcrowding. The similar results were also recorded by Maya *et al.* (1997) in sweet pepper cv. California Wonder, Rahman *et al*. (2007) [22] in amaranth (*Amaranthus lividus* L.), Alam *et al*. (2011) [3] in sweet pepper (*Capsicum annuum*), Islam *et al*. (2014) [13] and Pawar *et al.* (2021) [21] in Indian spinach (*Basella rubra* L.).

The data presented in Table 2 indicated that different trailing systems had a significant effect on the total number of harvests, total herbage yield per plant (g), total herbage yield per plot (kg) and total herbage yield per hectare (t/ha). The highest number of harvests (13.78) which can be, yield per plot (21.85 kg) and yield per hectare (22.58 t/ha) were recorded in S_3 (15 cm × 30 cm), attributed to higher plant density and faster canopy development, which enhanced productivity and enabled more frequent harvesting. The lowest number of harvests (10.11), yield per plot (7.75 kg) and yield per hectare (7.55 t/ha) were recorded in S_1 (45 cm × 30 cm), due to low plant population, reduced biomass accumulation and slower canopy coverage. The highest herbage yield per plant (190.96 g) was observed in S_2 (30 cm × 30 cm), resulting from an optimal balance between plant density and resource availability, improving light interception and nutrient uptake. The lowest yield per plant (183.73 g) was recorded in S_1, associated with wider spacing. The similar results were also recorded by Ghadge (2014) [9] in okra (*Abelmoschus esculentus* (L.) Moench) cv. Phule Utkarsha, Pawar *et al*. (2021) [21] and Islam *et al*. (2014) [13] in Indian spinach (*Basella alba* L.) and Mujahid and Gupta (2010) in lettuce (*Lactuca sativa*) [18].

Effect of trailing system (T)

Growth parameters: The different trailing systems had a significant effect on vine length (cm), number of leaves,

number of branches and number of nodes during experimentation shown in Table 1 (a) and (b). At 210 DAP, the longest vine length (73.56 cm) was recorded in T_3 (trailing on low bower), which was significantly higher than other trailing systems, attributed to improved sunlight availability and air circulation throughout the growth period, both essential for healthy vine development. Low bower trailing also reduced physical stress on the vines and minimized disease incidence. The shortest vine length (64.78 cm) was observed in T_2 (no trailing). The highest number of leaves (62.67) at 210 DAP was also recorded in T_3, attributed to enhanced light interception, reduced disease occurrence and decreased mechanical stress, promoting the production of more healthy leaves. This was at par with T_1 (ground trailing), which recorded 60.00 leaves, while the lowest number (57.89) was noted in T_2. At 90 DAP, T_1 recorded the highest number of branches (1.51), followed by T_3 (1.31), as both systems improved light exposure, air circulation, and nutrient uptake while reducing stress. The lowest number of branches (1.07) was found in T_2. At 180 DAP, T_3 significantly recorded the maximum number of nodes (20.80), as the bower system supported vine growth by enhancing microclimatic conditions and reducing mechanical stress, leading to better vegetative growth. The lowest number of nodes (17.38) was recorded in T_2. Similar findings were recorded in ridge gourd (*Luffa acutangula* L. Roxb) by Hilli *et al*. (2009) and Ahmed *et al.* (2021), Kalyanrao *et al*. (2012) and Sharma *et al*. (2016) in bottle gourd (*Lagenaria siceraria*), Singh *et al*. (2014) in bitter gourd, Kapuriya *et al.* (2017) and Hamayoun *et al.* (2018) in cucumber (*Cucumis sativus* L.) [12, 2, 14, 24, 25, 15, 11].

Yield parameters: The data presented in Table 2 indicated that different trailing systems had a significant effect on the total number of harvests, total herbage yield per plant (g), total herbage yield per plot (kg) and total herbage yield per hectare (t/ha). The total number of harvests was significantly influenced by the trailing system. The maximum number of harvests (12.56) was recorded in T_3 (trailing on low bower), attributed to better plant support, improved light interception and reduced disease incidence, which promoted continuous and healthy sprout development. This was at par with T_1 (ground trailing), which recorded 12.44 harvests, while the minimum (10.44) was observed in T_2 (No trailing), where the absence of support led to poor plant structure, increased disease susceptibility and reduced sprouting, thereby limiting harvesting frequency. Similarly, the highest total herbage yield per plant (201.56 g), per plot (13.96 kg) and per hectare (14.40 t/ha) was observed in T_3, as the low bower system provided optimal support, enhanced light penetration and improved air circulation, promoting vigorous growth and sustained yield. The lowest yield per plant (170.16 g), per plot (13.35 kg) and per hectare (13.31 t/ha) was recorded in T_2, due to the lack of support, which resulted in weak plant structure, reduced light exposure and higher disease incidence, ultimately limiting yield potential. The similar results were also recorded by Ahmed *et al.* (2021) in ridge guard (*Luffa acutangula* Roxb), Kalyanrao *et al*. (2012) and Sharma *et al.* (2016) in bottle gourd (*Lagenaria siceraria*), Kapuriya *et al*. (2017) in cucumber (*Cucumis sativus* L.) and Chukwudi and Agbo (2014) in pumpkin (*Telfairia occidentalis* Hook F.) [12, 14, 24, 15, 6].

Interaction Effect of spacing and trailing system (SXT)

Growth parameters: The different spacings and trailing systems had a significant effect on vine length (cm), number of leaves, number of branches and number of nodes during experimentation shown in Table 1 (a) and (b). At 210 DAP, the highest vine length (81.67 cm) was recorded in S_1T_3, where wider spacing (45 cm × 30 cm) allowed better resource availability and low bower trailing improved air circulation and structural support. The lowest vine length (60.33 cm) was observed in S_3T_1, were closer spacing and lack of support restricted growth. The number of leaves was recorded maximum (66.00) in S_3T_1, which was at par with at par with S_3T_2, S_3T_3, S_2T_3 and S_1T_3. Bower systems enhanced microclimatic conditions, reduced plant stress and promoted higher leaf development. The minimum number of leaves (52.00) was recorded in S_1T_2. At 90 DAP, the highest number of branches (2.20) was recorded in S_2T_1, supported by adequate spacing and structural assistance, while the lowest (0.87) was in S_3T_2. At 180 DAP, S_1T_3 recorded the highest number of nodes (23.93) as wider spacing and bower training supported better vegetative growth. The lowest (15.80) was recorded in S_3T_1. The highest values across these parameters were generally observed around 120 DAP, which corresponds to the peak vegetative growth period of the crop, when environmental conditions and physiological activity most favor biomass accumulation. Similar findings were recorded by Hamayoun *et al*. (2018) [11] in cucumber (*Cucumis sativus* L.).

Table 1 (a): Effect of spacing and trailing system on growth parameters in Indian spinach (Basella alba L.)

Treatment	Growth parameters					
	Vine length (cm)			Number of leaves/vines		
	60 DAP	120 DAP	180 DAP	60 DAP	120 DAP	180 DAP
S1	17.07	41.16	67.33	11.20	27.11	53.62
S2	15.78	38.91	61.93	10.53	32.58	57.78
S3	12.98	35.51	57.11	9.60	36.80	61.67
S.E.m±	0.41	0.60	0.92	0.40	0.53	0.29
CD@5%	1.23	1.79	2.75	1.21	1.58	0.88
Result	SIG	SIG	SIG	SIG	SIG	SIG
T1	14.69	40.93	60.78	9.67	33.38	59.09
T2	14.57	32.98	56.60	10.18	29.24	54.89
T3	16.22	41.67	69.00	11.49	33.87	59.09
S.E.m±	0.41	0.60	0.92	0.40	0.53	0.29
CD@5%	1.23	1.79	2.75	1.21	1.58	0.88
Result	SIG	SIG	SIG	SIG	SIG	SIG
S1T1	18.33	45.47	68.67	11.47	29.13	54.20
S1T2	13.73	35.33	57.67	11.13	25.20	50.33
S1T3	19.13	47.67	75.67	11.00	27.00	56.33

S2T1	13.40	40.33	59.00	10.73	33.73	59.67
S2T2	16.00	34.60	58.13	8.60	29.73	55.00
S2T3	16.93	41.80	68.67	12.27	34.27	58.67
S3T1	12.33	37.00	54.67	6.80	37.27	63.40
S3T2	14.00	29.00	54.00	10.80	32.80	59.33
S3T3	12.60	40.53	62.67	11.20	40.33	62.27
S.E.m±	0.71	1.03	1.59	0.70	0.91	0.51
CD@5%	2.13	3.10	4.77	2.09	2.74	1.52
Result	SIG	SIG	SIG	SIG	SIG	SIG

Table 1 (b): Effect of spacing and trailing system on growth parameters in Indian spinach (Basella alba L.)

Treatment	Growth parameters					
	Number of branches			Number of nodes		
	60 DAP	120 DAP	180 DAP	60 DAP	120 DAP	180 DAP
S1	0.96	1.73	0.56	8.36	11.71	21.49
S2	0.92	1.80	0.44	7.96	9.56	18.40
S3	1.09	1.20	0.56	6.58	8.38	16.89
S.E.m±	0.03	0.04	0.02	0.34	0.20	0.32
CD@5%	0.08	0.11	0.07	-	0.59	0.97
Result	SIG	SIG	SIG	NS	SIG	SIG
T1	0.93	1.44	0.67	7.36	11.04	18.60
T2	0.88	1.18	0.31	7.51	7.22	17.38
T3	1.16	1.49	0.58	8.02	11.38	20.80
S.E.m±	0.03	0.04	0.02	0.34	0.20	0.32
CD@5%	0.08	0.11	0.07	1.02	0.59	0.97
Result	SIG	SIG	SIG	SIG	SIG	SIG
S1T1	1.07	1.80	0.80	9.13	13.40	21.87
S1T2	0.73	1.20	0.27	6.87	8.20	18.67
S1T3	1.07	2.20	0.60	9.07	13.53	23.93
S2T1	0.87	0.93	0.53	6.73	10.67	18.13
S2T2	0.83	1.40	0.33	8.47	7.20	17.13
S2T3	1.07	1.20	0.47	8.67	10.80	19.93
S3T1	0.87	1.60	0.67	6.20	9.07	15.80
S3T2	1.07	0.93	0.33	7.20	6.27	16.33
S3T3	1.33	1.07	0.67	6.33	9.80	18.53
S.E.m±	0.05	0.07	0.04	0.59	0.34	0.56
CD@5%	0.14	0.20	0.12	1.76	1.02	1.67
Result	SIG	SIG	SIG	SIG	SIG	SIG

Table 2: Effect of spacing and trailing system on yield parameters in Indian spinach (Basella alba L.)

Treatment	Yield parameters			
	Total number of harvests	Total herbage yield/plant (g)	Total herbage yield/plot (kg)	Total herbage yield (t/ha)
S1	10.11	183.73	7.75	7.55
S2	11.56	190.96	11.52	11.24
S3	13.78	187.18	21.85	22.58
S.E.m±	0.30	1.24	0.16	0.17
CD@5%	0.91	3.72	0.48	0.52
Result	SIG	SIG	SIG	SIG
T1	12.44	190.16	13.81	13.65
T2	10.44	170.16	13.35	13.31
T3	12.56	201.56	13.96	14.40
S.E.m±	0.30	1.24	0.16	0.17
CD@5%	0.91	3.72	0.48	0.52
Result	SIG	SIG	SIG	SIG
S1T1	10.67	184.20	7.92	7.57
S1T2	9.67	157.13	7.00	6.87
S1T3	10.00	209.87	8.31	8.22
S2T1	11.67	202.27	11.94	11.54
S2T2	9.67	166.80	10.61	10.34
S2T3	13.33	203.80	12.01	11.84
S3T1	15.00	184.00	21.57	21.84
S3T2	12.00	186.53	22.43	22.73
S3T3	14.33	191.00	21.56	23.16
S.E.m±	0.53	2.15	0.28	0.30
CD@5%	1.58	6.45	0.83	0.91
Result	SIG	SIG	SIG	SIG

Conclusion

The present study revealed that spacing and trailing system influenced the growth and yield parameters of Indian spinach (*Basella alba* L.). Among the different spacing treatments, S_1T_1 (45 cm x 30 cm spacing with ground) was found to be superior in terms of various growth parameters. Thus, considering the yield of basella, S_3T_3 (15 cm x 30 cm spacing with bower trailing on low bower) found to be beneficial for Konkan agro climatic conditions.

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References

1. Adeyeye AS, Akanbi WB, Olalekan KK, Lamidi WA, Othman HJ, Ishaku MA. Growth and yield performance of sweet melon as affected by planting spacing in North East Nigeria. Int J Res Agric For. 2017;4(8):17-21.
2. Ahmed I, Ahmed N, Waheed A, Khan MA, Khan N, Ahmed F. Impact of growing methods and direction of sowing on the plant growth and seed production of ridge guard (Luffa acutangula Roxb). Sarhad J Agric. 2021;37(3):747-753.
3. Alam MS, Saha SR, Salam MA, Alam MS, Alam MK. Effect of sowing time and plant spacing on yield and yield attributes of sweet pepper (Capsicum annuum). Bangladesh J Agric Res. 2011;36(1):271-278.
4. Almeida MR. Flora of Maharashtra. Mumbai: Blatter Herbarium, St. Xavier's College; 2003. Vol. 4, p. 278.
5. Anonymous. Malabar Spinach (Ceylon Spinach, Poi Sag) - Basella alba, Basella rubra. ECHO Plant Information Sheet. 2006.
6. Chukwudi UP, Agbo CU. Effect of trellis height and cutting frequency on leaf and fruit yield of fluted pumpkin (Telfairia occidentalis Hook. f.). J Anim Plant Sci. 2014;24(4):264-267.
7. Deshmukh SA, Gaikwad DK. A review of the taxonomy, ethnobotany, phytochemistry, and pharmacology of Basella alba (Basellaceae). J Appl Pharm Sci. 2014;4(0):153-165.
8. Facciola S. Cornucopia - A source book of edible plants. USA: Kampong Publications; 1990. p. 183-187.
9. Ghadge AG. Effect of different spacing and picking on seed yield and seed quality of okra (Abelmoschus esculentus (L.) Moench) cv. Phule Utkarsha [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2014.
10. Grubben GJH, Denton OA. Plant Resources of Tropical Africa 2: Vegetables. Wageningen, Netherlands: PROTA Foundation; 2004. p. 44-111.
11. Hamayoun H, Darwiash MO, Tajzadh AW, Akramzoi I, Aslami Z. Response of growth and yield of cucumber (Cucumis sativus L.) to staking and plant spacing under protected culture. e-Planet. 2018;16(2):147-152.
12. Hilli JS, Vyakarnahal BS, Biradar DP, Hunje R. Influence of method of trailing and fertilizer levels on seed yield of ridge gourd (Luffa acutangula L. Roxb.). Karnataka J Agric Sci. 2009;22(1):47-52.
13. Islam AB, Kamrujjaman MJ, Iqbal M, Momin MA, Hossain MA. Effect of spacing on the growth and yield of Indian spinach (Basella alba L.). Int J Bio-Res. 2014;16(2):5-13.
14. Kalyanrao B, Tomar S, Singh B. Influence of vertical trailing on seed yield and quality during seed production of bottle gourd (Lagenaria siceraria) cv. Pusa Hybrid-3. Seed Res. 2012;40(2):139-144.
15. Kapuriya VK, Ameta KD, Teli SK, Chittora A, Gathala S, Yadav S. Effect of spacing and training on growth and yield of polyhouse grown cucumber (Cucumis sativus L.). Int J Curr Microbiol Appl Sci. 2017;6(8):299-304.
16. Mahr S. Malabar spinach, Basella alba. Madison, WI: Master Gardener Program, Division of Extension; 2014.
17. Maya P, Natarajan S, Thamburaj S. Effect of spacing, N and P on growth and yield of sweet pepper cv. California Wonder. South Indian Hortic. 1997;45(1/2):16-18.
18. Mujahid AM, Gupta AJ. Effect of plant spacing, organic manures and inorganic fertilizers and their combinations on growth, yield and quality of lettuce (Lactuca sativa). Indian J Agric Sci. 2010;80(2):177-181.
19. Palada MC, Crossman SMA. Evaluation of tropical leaf vegetables in the Virgin Islands. In: Janick J, editor. Perspectives on New Crops and New Uses. Alexandria, VA: ASHS Press; 1999. p. 388-393.
20. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: ICAR; 1995. p. 97-156. Rev. ed.
21. Pawar TS, Haldavanekar PC, Pawar CD, Kasture MC. Effect of spacing and organic manure on growth and yield performance of Indian spinach (Basella rubra L.) [MSc thesis]. Dapoli: Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2021.
22. Rahman MJ, Uddain J, Halim MA. Effect of different levels of nitrogen and spacing on the growth and yield of stem amaranth (Amaranthus lividus L.). J Sher-e-Bangla Agric Univ. 2007;1(1):30-38.
23. Sarkar RK, Jana JC, Datta S. Effect of different sowing times and spacings on growth, yield and quality of water spinach (Ipomoea reptans Poir.) under terai region of West Bengal. J Appl Nat Sci. 2014;6(2):489-94.
24. Sharma RK, Tomar BS, Singh SP, Kumar A. Effect of growing methods on seed yield and quality in bottle gourd (Lagenaria siceraria). Indian J Agric Sci. 2016;86(3):373-378.
25. Singh PM, Singh R, Bhardwaj DR. Effect of training system on seed yield and quality of bitter gourd cv. 'Kalyanpur Baramasi' under herbicide managed crop. Ann Plant Soil Res. 2014;16(2):155-158.