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Leaf yield and quality parameters as influenced by spacing and planting season of sweet basil (*Ocimum basilicum*)

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Abstract

An experiment was carried out during the years 2019-21 at College of Horticulture, Venkataramannagudem, West Godavari District of Andhra Pradesh. Data were recorded on yield parameters like leaf yield per plant, leaf yield per plot and quality parameters carbohydrate content, chlorophyll content, phenol content and aroma score for fresh leaves. Among the treatment combinations, spacing of 60 cm x 75 cm + late *Kharif* planting (S₄P₂) was found to record maximum leaf yield per plant, leaf yield per plot, carbohydrate content, chlorophyll content and aroma score for fresh leaves. The closest spacing of 60 cm x 30 cm + late *Kharif* planting (S₁P₂) was found to be significantly superior in phenol content as compared to the rest of treatments.

Keywords: Sweet basil, spacing, planting season, yield and quality parameters

Introduction

Ocimum basilicum is popularly known as sweet basil and has been an important element in folk medicine. It belongs to the family Lamiaceae (Labiatae). The genus *Ocimum* contain about 50 to 150 species of herbs and shrubs from the tropical regions in Asia, Africa, Central and South America (Darrah, 1980) [1]. It is one of the most important aromatic medicinal plants since time immemorial. Being a polymorphic group of economically useful herbs, it forms a rich source of many naturally occurring essential oils and aromatic chemicals (Khosla *et al.*, 2000) [2]. The leaves and inflorescences of sweet basil are used as carminative, galactagogue, stomachic, and antispasmodic in folk medicine (Pragya *et al.*, 2016) [3]

Materials and Methods

A field experiment was conducted at College of Horticulture, Venkataramannagudem, Dr. YSRHU, West Godavari District of Andhra Pradesh during the years 2019-20 and 2020-21. on the effect of spacing and season of planting on yield and quality of sweet basil (*Ocimum basilicum*). There were 16 treatment combinations consisting of two factors *viz.*, plant spacing – 4 levels (S₁:60 cm x 30 cm, S₂: 60 cm x 45 cm, S₃:60 cm x 60 cm S₄:60 cm x 75 cm) and planting season – 4 levels (P₁: *Kharif*, P₂: late *Kharif* and P₃: *Rabi* P₄: late *Rabi*) laid out in factorial concept making sixteen combinations replicated twice. FYM was applied @ 15 q/ha uniformly to all treatments at the time of seed sowing. N:P:K were applied at the rate of 120:30:20 Kg/ha (RDF). Seedlings were transplanted in the experimental field at the age of thirty days.

Results and Discussion

Leaf yield per plant (g)

Data presented in Table 1 indicated significant effect of spacing, planting season and their interaction on leaf yield per plant in pooled analysis.

The highest leaf yield per plant (349.75 g) was recorded at 60 cm x 75 cm (S₄) spacing followed by 60 cm x 60 cm (S₃) spacing (329.63 g).

The leaf yield per plant was significantly highest in late *Kharif* (P₂) planting (320.17g) which was followed by *Rabi* (P₃) planting (286.69 g). The lowest leaf yield per plant was recorded by late *Rabi* (P₄) (273.57 g).

Among the interactions, leaf yield per plant (382.00 g) was maximum under S₄P₂ combination (spacing of 60 cm x 75 cm + late *Kharif*) which was on par with S₃P₂ (60 cm x 60 cm + late *Kharif*) (353.03 g) and minimum was recorded by S₁P₄ (60 cm x 30 cm + late *Rabi*) (201.95 g).

Table 1: Leaf yield per plant (g) as influenced by spacing and season of planting in sweet basil (*Ocimum basilicum*)

Spacing (S)	Leaf yield per plant (g)														
	2019-2020					2020-2021					Pooled data				
	Season of planting (P)														
	P ₁	P ₂	P ₃	P ₄	Mean	P ₁	P ₂	P ₃	P ₄	Mean	P ₁	P ₂	P ₃	P ₄	Mean
	Kharif	Late Kharif	Rabi	Late Rabi		Kharif	Late Kharif	Rabi	Late Rabi		Kharif	Late Kharif	Rabi	Late Rabi	
S ₁ : 60 cm x 30 cm	206.60	250.10	215.30	201.90	218.48	208.40	258.50	218.25	202.00	221.79	207.50	254.30	216.78	201.95	220.14
S ₂ : 60 cm x 45 cm	242.50	287.20	257.75	240.25	256.93	245.25	295.50	259.60	242.40	260.69	243.88	291.35	258.68	241.33	258.81
S ₃ : 60 cm x 60 cm	320.50	355.80	324.25	316.40	329.24	324.80	350.25	326.40	318.60	330.01	322.65	353.03	325.33	317.50	329.63
S ₄ : 60 cm x 75 cm	338.25	381.50	342.40	334.50	349.16	336.80	382.50	349.50	332.50	350.33	337.53	382.00	345.95	333.50	349.75
Mean	276.96	318.65	284.93	273.26	288.45	278.81	321.69	288.44	273.88	290.70	277.89	320.17	286.69	273.57	289.58
Factor	S Em(±)				CD at 5%	S Em(±)				CD at 5%	S Em(±)				CD at 5%
Spacing (S)	6.14				18.42	5.75				17.24	5.94				17.80
Planting season (P)	6.14				18.42	5.75				17.24	5.94				17.80
Sp. x Ptg. Sn.(S x P)	10.45				31.32	9.78				29.31	10.09				30.26

Leaf yield per plot (kg)

A perusal of data presented in Table 2 indicated significant differences in leaf yield per plot due to spacing, planting season and their interactions in pooled analysis.

The leaf yield per plot varied significantly from a maximum pooled value of 14.44 kg at spacing of 60 cm x 30 cm (S₁). The minimum leaf yield per plot (6.78 kg) was recorded at a spacing of 60 cm x 75 cm (S₄).

The leaf yield per plot (12.62 kg) was at the highest in late *Kharif* (P₂) which was followed by *Rabi* (P₃) (10.90 kg) and the lowest was recorded by late *Rabi* (P₄) planting (9.71 kg).

Among the interaction S₁P₂ (60 cm x 30 cm spacing + late *Kharif*) recorded maximum leaf yield per plot (16.25 kg) which was followed by S₁P₃ (60 cm x 30 cm + *Rabi*) (14.16 kg) and lowest leaf yield per plot was recorded by S₄P₄ (60 cm x 75 cm spacing + late *Rabi*) (5.40 kg).

Significant differences were also noticed due to season in leaf yield per plant. The highest weight of leaf was harvested from late *Kharif* and *Kharif* planted crops, which can be also attributed to favourable range of weather parameters. Higher leaf yield in late *Kharif* and *Kharif* crops might be due to increased number of leaves and leaf area per plant, as recorded under such treatments of favourable planting dates, which might be responsible for synthesising and translocating more photosynthates resulting in better plant growth in terms of plant height, plant spread and number of branches ultimately leading to higher leaf and oil yields. Menthol mint planted in July was significantly superior in terms of fresh herbage yield, shade dried herbage yield and essential oil yield while minimum values were recorded by planting in August. These findings are in agreement to those reported by and Sarma and Kanjilal (1999) [41] in mint.

Table 2: Leaf yield per plot (kg) as influenced by spacing and season of planting in sweet basil (*Ocimum basilicum*)

Spacing (S)	Leaf yield per plot (kg)														
	2019-2020					2020-2021					Pooled data				
	Season of planting (P)														
	P ₁	P ₂	P ₃	P ₄	Mean	P ₁	P ₂	P ₃	P ₄	Mean	P ₁	P ₂	P ₃	P ₄	Mean
	Kharif	Late Kharif	Rabi	Late Rabi		Kharif	Late Kharif	Rabi	Late Rabi		Kharif	Late Kharif	Rabi	Late Rabi	
S ₁ : 60 cm x 30 cm	13.90	16.30	14.21	13.85	14.57	13.52	16.20	14.10	13.42	14.31	13.71	16.25	14.16	13.64	14.44
S ₂ : 60 cm x 45 cm	11.20	13.80	12.15	10.85	12.00	11.12	13.60	12.00	10.45	11.79	11.16	13.70	12.08	10.65	11.90
S ₃ : 60 cm x 60 cm	10.10	11.95	10.80	9.20	10.51	10.45	11.82	10.56	9.10	10.48	10.28	11.89	10.68	9.15	10.50
S ₄ : 60 cm x 75 cm	6.20	9.20	6.80	5.50	6.93	6.60	8.05	6.60	5.30	6.64	6.40	8.63	6.70	5.40	6.78
Mean	10.35	12.81	10.99	9.85	11.00	10.42	12.42	10.82	9.57	10.81	10.39	12.62	10.90	9.71	10.90
Factor	S Em(±)				CD at 5%	S Em(±)				CD at 5%	S Em(±)				CD at 5%
Spacing (S)	0.40				1.20	0.40				1.20	0.40				1.20
Planting season (P)	0.40				1.20	0.40				1.20	0.40				1.20
Sp. x Ptg. Sn.(S x P)	0.68				2.03	0.68				2.04	0.68				2.04

Carbohydrate content (%)

The data presented in Table 3 indicated significant effect of spacing, planting season and their interaction on carbohydrate content of leaves in pooled analysis.

As per pooled analysis, spacing showed their significant effect on carbohydrate content. The superior carbohydrate content was observed at a spacing of (S₄) 60 cm x 75 cm (36.43 %) followed by spacing of (S₃) 60 cm x 60 cm (30.63%).

Planting season in late *Kharif* (P₂) recorded highest carbohydrate content (35.16%) which was followed by *Rabi* (P₃) (30.27%).

Among interactions, the highest carbohydrate content (43.84%) was recorded from the treatment combination of

S₄P₂ (60 cm x 75 cm + late *Kharif*) which was followed by S₃P₂ (60 cm x 60 cm + late *Kharif*) (39.12%) and the lowest carbohydrate content was recorded by S₁P₄ (60 cm x 30 cm + late *Rabi*) (16.67%).

In the present study, significantly maximum leaf carbohydrate content was recorded under the widest spacing i.e. S₄ (60 cm x 75 cm) while, minimum carbohydrate content was noticed in S₁ (60 cm x 30 cm). This enhancement might be due to better light harvest, moisture holding capacity, supply of macro nutrients and availability of major nutrients in the soil due to favourable conditions created by spacing. The present results are in close conformity with the findings of Sunita *et al.* (2017) [51] in sweet potato.

Table 3: Carbohydrate content (%) as influenced by spacing and season of planting in sweet basil (*Ocimum basilicum*)

Spacing (S)	Carbohydrate content (%)														
	2019-2020					2020-2021					Pooled data				
	Season of planting (P)														
	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean
S ₁ : 60 cm x 30 cm	19.50	25.44	21.35	17.51	20.95	18.08	26.44	20.35	15.83	20.18	18.79	25.94	20.85	16.67	20.57
S ₂ : 60 cm x 45 cm	22.38	31.43	26.40	19.52	24.93	24.31	32.00	27.40	20.41	26.03	23.35	31.72	26.90	19.97	25.48
S ₃ : 60 cm x 60 cm	26.13	38.74	32.30	22.46	29.91	25.50	39.50	36.91	23.46	31.34	25.82	39.12	34.61	22.96	30.63
S ₄ : 60 cm x 75 cm	32.12	43.34	38.20	28.08	35.44	35.12	44.34	39.25	30.92	37.41	33.62	43.84	38.73	29.50	36.43
Mean	25.03	34.74	29.56	21.89	27.81	25.75	35.57	30.98	22.66	28.74	25.39	35.16	30.27	22.28	28.28
Factor	S Em(±)				CD at 5%	S Em(±)				CD at 5%	S Em(±)				CD at 5%
Spacing (S)	0.40				1.22	0.45				1.36	0.42				1.28
Planting season (P)	0.40				1.22	0.45				1.36	0.42				1.28
Sp. x Ptg. Sn.(S x P)	0.69				2.07	0.76				2.31	0.72				2.17

Chlorophyll content

The spacing, planting season and their interaction significantly influenced chlorophyll content of leaves (Table 4) in pooled analysis. The pooled results exhibited that plant spacing showed significant effect on chlorophyll content and it was found to increase with increase in spacing. The plants at 60 cm x 75 cm (S₄) spacing produced leaves having significantly highest chlorophyll content (46.09) followed by those spaced at 60 cm x 60 cm (S₃) (41.95). Late *Kharif* (P₂) planting resulted in the highest chlorophyll content (40.69) which was followed by *Rabi* (P₃) (38.81). Among the interaction, the combination of S₄P₂ (60 cm x 75 cm + late *Kharif*) showed the highest chlorophyll content (48.93) on par with S₄P₃ (60 cm x 75 cm + *Rabi*) (46.50) and the least chlorophyll content (26.91) was observed with a

treatment combination of S₁P₄ (60 cm x 30 cm + late *Rabi*). At sub-optimal or low temperatures, the levels of carotenoids, plastoquinones and cytochromes are increased in leaves and, shortly after a temperature drop, leaves contained lower concentrations of both chlorophyll a and chlorophyll b. Vimala and Poonghuzhali (2015)^[6] noticed that the highest amount of chlorophyll a, chlorophyll b, total chlorophyll and total carotenoids contents were found for *Ocimum sanctum* (Tulsi) in winter harvest (October) as compared to still early and later leaf harvests. The total chlorophyll amount found in October was more than double in comparison with July month. That is why the highest chlorophyll content was recorded by late *Kharif* sown crop which matured its leaves in October in the sweet basil as was also observed in sacred basil in the present study.

Table 4: Chlorophyll content (SPAD units) as influenced by spacing and season of planting in sweet basil (*Ocimum basilicum*)

Spacing (S)	Chlorophyll content (SPAD units)														
	2019-2020					2020-2021					Pooled data				
	Season of planting (P)														
	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean
S ₁ : 60 cm x 30 cm	27.51	29.96	28.20	26.20	27.97	29.20	32.50	29.20	28.50	29.13	27.35	31.23	28.70	26.91	28.55
S ₂ : 60 cm x 45 cm	34.90	37.60	36.00	32.12	35.16	34.20	39.00	38.20	35.10	36.63	35.00	38.30	37.10	33.16	35.89
S ₃ : 60 cm x 60 cm	40.86	43.41	42.68	39.34	41.57	42.00	45.20	43.20	38.90	42.33	39.88	44.31	42.94	40.67	41.95
S ₄ : 60 cm x 75 cm	45.00	48.20	46.50	43.90	45.90	45.20	49.65	46.50	43.80	46.29	44.40	48.93	46.50	44.55	46.09
Mean	37.07	39.79	38.35	35.39	37.65	37.65	41.59	39.28	36.58	38.59	36.66	40.69	38.81	36.32	38.12
Factor	S Em(+)				CD at 5%	S Em(+)				CD at 5%	S Em(+)				CD at 5%
Spacing (S)	0.98				2.93	0.93				2.79	0.95				2.86
Planting season (P)	0.98				2.93	0.93				2.79	0.95				2.86
Sp. x Ptg. Sn.(S x P)	1.66				4.98	1.58				4.75	1.62				4.86

Phenol content (mg 100 g⁻¹)

The data presented in Table 5 indicated significant effect of spacing, planting season and their interaction on phenol content of leaves in pooled analysis. As per pooled analysis, the superior phenol content was observed at a spacing of 60 cm x 30 cm (S₁) (227.37 mg 100 g⁻¹) followed by spacing of 60 cm x 45 cm (S₂) (221.37 mg 100 g⁻¹). Phenol content in leaves from plants with late *Kharif* (P₂)

planting was at the highest (223.64 mg 100 g⁻¹) which was followed by *Rabi* planting (P₃) (212.82 mg 100 g⁻¹). Among the interaction, the highest phenol content (240.50 mg 100 g⁻¹) was recorded from the treatment combination of S₁P₂ (60 cm x 30 cm spacing + late *Kharif*) which was followed by S₂P₂ (60 cm x 45 cm spacing + late *Kharif*) (231.58 mg 100 g⁻¹) and the lowest phenol content was recorded by S₄P₄ (60 cm x 75 cm spacing + late *Rabi*) (180.03 mg 100 g⁻¹).

Table 5: Phenol content (mg 100 g⁻¹) as influenced by spacing and season of planting in sweet basil (*Ocimum basilicum*)

Spacing (S)	Phenol content (mg 100 g ⁻¹)														
	2019-2020					2020-2021					Pooled data				
	Season of planting (P)														
	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean	P ₁ Kharif	P ₂ Late Kharif	P ₃ Rabi	P ₄ Late Rabi	Mean
S ₁ : 60 cm x 30 cm	220.43	237.41	228.63	218.07	226.14	220.00	243.58	232.71	218.12	228.60	220.22	240.50	230.67	218.10	227.37
S ₂ : 60 cm x 45 cm	216.55	231.08	220.58	212.00	220.05	218.05	232.08	225.58	215.02	222.68	217.30	231.58	223.08	213.51	221.37
S ₃ : 60 cm x 60 cm	209.33	217.41	208.15	204.08	209.74	204.15	219.58	210.34	201.08	208.79	206.74	218.50	209.25	202.58	209.27
S ₄ : 60 cm x 75 cm	180.17	202.13	185.91	179.53	186.94	186.15	205.84	190.61	180.53	190.78	183.16	203.99	188.26	180.03	188.86
Mean	206.62	222.01	210.82	203.42	210.72	207.09	225.27	214.81	203.69	212.71	206.86	223.64	212.82	203.56	211.72
Factor	S Em(+)				CD at 5%	S Em(+)				CD at 5%	S Em(+)				CD at 5%

Spacing (S)	1.21	3.64	1.45	4.37	1.33	4.00
Planting season (P)	1.21	3.64	1.45	4.37	1.33	4.00
Sp. x Ptg. Sn.(S x P)	2.05	6.19	2.46	7.43	2.25	6.80

Aroma score of fresh leaves

The effect of spacing, planting season and their interaction on aroma score of fresh leaves (Table 6) was significant in the pooled analysis. The maximum aroma score of fresh leaves was observed at a spacing of 60 cm x 75 cm (S₄) (3.65) followed by spacing of 60 cm x 60 cm (S₃) (2.99).

The aroma score of fresh leaves was maximum in late *Kharif*

(P₂) planting (3.24) was followed by *Rabi* (P₃) planting (2.76). Among the interaction means, the highest aroma score of fresh leaves of 4.68 was recorded from treatment combination of S₄P₂ (60 cm x 75 cm + late *Kharif*) and it was followed by S₄P₃ (60 cm x 75 cm + *Rabi*) (3.74) and the lowest aroma score of fresh leaves was recorded by S₁P₄ (60 cm x 30 cm + late *Rabi*) (1.12).

Table 6: Aroma score for fresh leaves as influenced by spacing and season of planting in sweet basil (*Ocimum basilicum*)

Aroma score for fresh leaves															
Spacing (S)	2019-2020					2020-2021					Pooled data				
	Season of planting (P)										P ₁ <i>Kharif</i>	P ₂ Late <i>Kharif</i>	P ₃ <i>Rabi</i>	P ₄ Late <i>Rabi</i>	Mean
	P ₁ <i>Kharif</i>	P ₂ Late <i>Kharif</i>	P ₃ <i>Rabi</i>	P ₄ Late <i>Rabi</i>	Mean	P ₁ <i>Kharif</i>	P ₂ Late <i>Kharif</i>	P ₃ <i>Rabi</i>	P ₄ Late <i>Rabi</i>	Mean					
S ₁ : 60 cm x 30 cm	1.27	1.91	1.57	1.08	1.46	1.54	2.15	2.09	1.15	1.73	1.41	2.03	1.83	1.12	1.60
S ₂ : 60 cm x 45 cm	2.19	2.50	2.25	1.92	2.22	2.22	2.62	2.35	1.67	2.22	2.21	2.56	2.30	1.80	2.22
S ₃ : 60 cm x 60 cm	2.87	3.43	3.10	2.65	3.01	2.47	3.91	3.20	2.30	2.97	2.67	3.67	3.15	2.48	2.99
S ₄ : 60 cm x 75 cm	3.20	4.57	3.60	2.90	3.57	3.42	4.78	3.87	2.81	3.72	3.31	4.68	3.74	2.86	3.65
Mean	2.38	3.10	2.63	2.14	2.56	2.41	3.37	2.88	1.98	2.66	2.40	3.24	2.76	2.06	2.61
Factor	S Em(+)				CD at 5%	S Em(+)				CD at 5%	S Em(+)				CD at 5%
Spacing (S)	0.06				0.18	0.07				0.21	0.06				0.19
Planting season (P)	0.06				0.18	0.07				0.21	0.06				0.19
Sp. x Ptg. Sn.(S x P)	0.10				0.30	0.12				0.35	0.11				0.33

References

1. Darrah HH. The cultivated basils. Buckeye Printing Co. The University of Wisconsin, Madison 1980,55-56p.
2. Khosla MK, Bhasin M, Thappa RK. Essential oil composition of some improved species of *Ocimum*. *Indian Perfumer* 2000;44(3):175-81.
3. Pragya S, Gyanendra T, Mehta SC. Nitrogen and sulphur application affect phenology and essential oil productivity of french basil (*Ocimum basilicum*). *International Journal of Agriculture Sciences* 2016;8(35):1729-32.
4. Sharma PC, Kanjilal PB. Effect of planting time and density on yield and quality of peppermint (*Mentha piperita* L.) under sub-tropical condition. *Ancient Science of Life* 1999;18(3&4):1-5.
5. Sunita K, Singh SP, Manoj Kumar R, Suman G, Rajbala C. Effect of NPK, FYM and Vermicompost on growth, yield and quality of sweet potato (*Ipomoea batatas* Lam.). *Chemical Science Review and Letters* 2017b;6(21):495-99.
6. Vimala T, Poonghuzhali TV. Estimation of pigments from seaweeds by using acetone and DMSO. *International Journal of Science and Research* 2015;4:185-1854.