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Effect of Compost Along with Spraying Methyl Jasmonate and Potassium Silicate on The Productivity of French Basil under Sandy Soil Conditions

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Aromatic plants are a sustainable supply of flavouring ingredients that apply to the food, fragrance, and medicinal industries. To determine the effects of compost manure fertilization (2, 4, and 6 tons/ha) along with spraying of methyl jasmonate (20 and 30 ppm) and potassium silicate (1000 and 2000 ppm) on the vegetative growth and chemical components of sweet basil (*Ocimum basilicum* L.) plants, a field experiment was conducted at the Experimental Farm of El-Quassassin Horticultural Research Station, Ismailia Governorate, for two succeeding seasons (2021 and 2022). Four replications of a split-plot design with three treatments of compost manure fertilization in the main plot and three treatments of stimulants in the sub plot. The data collected showed that the foliar treatments of 2000 ppm K-silicate combined with 6.0 tons of compost manure per hectare of sweet basil plants produced themost significant levels of these traits. However, the highest values for plant height were from the application of 6 tons/ha of compost manure combined with 30 ppm of methyl jasmonate. The lowest values, in contrast, resulted from 2.0 tons of compost per hectare across both growing seasons under no stimulant conditions.

Keywords: Sweet basil, Compost manure, Methyl jasmonate, Potassium silicate.

1. Introduction

Lately, agriculture and industry have greatly benefited from the use of medicinal and aromatic herbs. They are the primary supplier of the raw materials and safety drugs utilized in the production of pharmaceuticals. The biological manufacture of some significant medications, including cortisone, sex hormones, plasma replacements, and others, occurs in some of its components, including the nucleus. Basil is grown on a much larger scale in Egypt than other medicinal and flavouring plants. Despite the country producing 7,000 tonnes, hardly any is consumed domestically. The majority of the crop is grown for export on nearly 3,078 hectares of basil farms, with shipping markets expanding from Europe to the USA and neighbouring countries. The local rich flavour variety is currently grown and exported(Industrial Modernization Centre, 2006; Toaima and Hamed, 2016; Negm and Shareef, 2020; and El-Shwarby *et al*., 2022).

To increase production and boost quality, basil is now grown on recently reclaimed land throughout the Egyptian desert. Adding sufficient organic nourishment to ensure great quality is one of the most reliable ways to grow basil in the challenging conditions of recently reclaimed soil. Numerous

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organic amendments can improve the physical and chemical properties of the soil in addition to increasing soil microbial activity. It encourages plant growth and provides plants with a slow and regular source of nutrients because nutrients are locked in organic molecules and must be released continuously by soil bacteria(Anwar *et al*., 2005; Farid *et al.*, 2014; Dolbal 2016; Leogrande and Vitti, 2019; Wijaya and Teo, 2019, and Pramod *et al*., 2020). The use of compost and organic amendments may have an impact on the nutritional status and soil organic matter levels. Because of the direct and indirect benefits that organic fertilizers have on improving soil qualities, plant growth, and yields, they have attracted a lot of interest from agriculturalists and environmentalists (Hachicha*et al*., 2009; Toumpeli*et al*., 2013; and Hussein *et al*., 2022). The use of compost to boost agricultural productivity has received widespread support from numerous research (Ippolito *et al*., 2010 and Tortosa*et al*., 2014). Compost can enhance the physio-chemical qualities of the soil in field trials when used as an organic supplement, which has a favourable impact on plant output (Rigane and Medhiioub, 2011; and Boutchich*et al*., 2018).

Recently, scientists have conducted substantial research on how to increase the amount of polyphenols in plants, which will improve their total nutritional and medicinal worth (Taie*et al.*, 2010). Overall, elicitors like jasmonic acid are considered to be plant signalling molecules that participate in some signal transduction systems, increase the gene expression of enzymes of the secondary metabolic pathway like PAL (phenylalanine ammonia lyase), an enzyme involved in the synthesis of phenolics through phenylpropanoid pathway, and consequently increase the amount of phenolic compounds(Ding *et al*., 2002). Many physiological and biochemical processes in plants, such as tendril coiling, pollen viability, tuber formation, organogenesis, male fertility, defence responses, fruit ripening, and ethylene production, are regulated by the plant hormone jasmonic acid. (An *et al*. 2019; Asghari *et al*. 2020; and Abeed *et al*. 2021). Additionally, there are no restrictions on its safe use as a substance to raise the calibre of food crops (McCarthy 2013; and Asghari *et al*., 2020). Exogenous methyl jasmonate improves the production of ethylene, anthocyanins, carotene, ascorbic acid, and antioxidant activity in a variety of fruit types, which improves quality characteristics (Wei *et al*., 2017). Age-related symptoms such as respiratory rate increases, substantial chlorophyll losses, and peroxidase and protease activity were all decreased by jasmonic acid (Koda, 1992).

Furthermore, these plant regulators have a big part to play in protecting plants from the harmful effects of oxidative damage brought on by salt stress (Hayat *et al*., 2012). Also, it has been demonstrated by numerous studies that the use of fertilizer components such as potassium silicate has a substantial impact on plant development. One of the elements that work to withstand stress and stimulate anti-oxidation systems is silicon. Silicon has a wide range of physiological functions, the most significant of which are improving photosynthesis, enhancing the capacity of roots to absorb nutrients required for plant growth and development, and lowering the toxicity of sodium ions and heavy elements. Inside plants, potassium serves a variety of purposes as well. Research has demonstrated that potassium is crucial for the direct or indirect activation of more than 80 enzymes, including transporter enzymes and enzymes that make proteins (Adrees*et al*., 2015; Ali *et al*., 2019; and Fayed *et al*., 2021).

In this study, the growth, vegetative development, and essential oil yield of basil plants growing in freshly reclaimed soil were assessed in relation to the use of organic fertiliser and foliar spraying with methyl jasmonate and potassium silicate, each at two levels.

2. MATERIALS AND METHODS

This study was conducted within the span of two seasons, 2021 and 2022, in the Experimental Farm of El-Quassassin Horticulture Research Station, Ismailia Governorate, Agricultural Research Center (A.R.C.), Egypt to assess the effects of organic fertilizer and foliar spraying with methyl jasmonate and potassium silicate at two levels on the vegetative growth, development, and essential oil yield of basil plants growing in newly reclaimed soil.

The Horticultural Research Institute, A.R.C., at El-Kanater El-Khairia, Kalubia Governorate, provided the French basil (*Ocimum basilicum* L.) plant seeds for this experiment. On March 15th for both seasons, seeds were sown in the nursery. After 45 days, the seedlings were transplanted into 6.0 m^2 (5.0 X 1.2 m) plots with the two drip irrigation lines placed 60 cm apart. Plants were spaced 25 cm apart upon transplantation. On the irrigation lines, the drippers (with a discharge rate of 2 liters/hour) were positioned 50 cm apart. All seedlings must be protected before, during, and after transplant.Agriculture best practices were followed.

The investigation setup was a split-plot design so the main plots included three compost manure levels before planting (2, 4, and 6 tons/hectare). Stimulants i.e., 0.0, methyl jasmonate 20 ppm (MJ20), methyl jasmonate 30 ppm (MJ30), potassium silicate 1000 ppm (KS1000), and potassium silicate 2000 ppm (KS2000) were utilized in the subplots. From Salhia Company for Investment and Agricultural Development, New Salhia Branch, Sharkia, Egypt, compost manure was purchased. During land preparation, compost manure was added before planting. The mechanical and chemical analysis of soil, as well as the analysis of compost fertilizers used in this study, were performed, and the results are shown in Tables (1 and 2) according to A.O.A.C.(1990).

Potassium silicate’s chemical make-up consisted of 25% silicon oxide and 10% potassium oxide. It is a synthetic substance that was bought from the Union for Agricultural Development Company. While, methyljasmonate, 95% $C_{13}H_{20}O_3$ from (Egyptian International Center for Import) Sigma- Aldrich product of USA. The methyl jasmonate (20 and 30 ppm) and potassium silicate (1000 and 2000 ppm) treatments were sprayed on the herb six times during the growing season, the first time one month after transplanting and the other five times at 15-day intervals. For the chemical fertilization treatment, plants received 190 kg N/ha of ammonium sulphate (20.5% N), 111 kg P_2O_5/ha of calcium superphosphate (15.5% P_2O_5), and 170 kg K_2O/ha of potassium sulphate (48% K_2O). Cutting the vegetative portions of the plants 10 cm above the soil’s surface allowed for two cuts to be made to the plants, one in each season on the 15th of August and the other in the 15th of October. The following details from the two seasons were noted in both cuts:

a.Vegetative growth characteristics: at the beginning of flowering, plant height (cm) and the number of branches/plant as well as fresh and dry weights of herb plant (g).

TABLE 1. Analysis of the experimental soil's chemistry and mechanics.

Soil properties	2021	2022
Physical properties:		
Particle size distribution:		
Clay (%)	2.52	2.75
Silt (%)	7.36	7.72
Sand (%)	90.12	89.53
Texture grade	Sandy	Sandy
Chemical properties:		
pH (1:2.5 soil-water suspension)	8.01	8.19
EC, (Soil paste ds m^{-1})	1.25	1.60
Organic matter (%)	0.08	0.11
$CaCO_3$ (%)	3.19	2.01
Available N (mg kg)	9.15	8.03
Available P (mg kg)	6.52	5.92
Available K (mg kg)	60.17	51.12

TABLE 2. A compost sample's chemical analysis.

Chemical composition	Value
pH	7.98
EC dS m^{-1}	4.56
Organic carbon%	23.54
Organic matter %	40.60
Total nitrogen%	1.02
Total phosphorus%	0.39
Total potassium%	0.81
C/N ratio	23.08

b. *yield measurements* were recorded at harvesting time: the fresh weight of herb ton/ha and dry weight of herb ton/ha.

c. *Determination of essential oil % and yield*:

$$\text{Volatile oil percentage} = \frac{\text{oil volume in the graduated tube}}{\text{dry weight of samples}} \times 100$$

Based on essential oil%, the volatile oil yield/ha was calculated.

d. *Pigment content determination*:

Chlorophyll a, b and carotenoid were determined in adult leaf fresh samples (mg/g F.W.) as described by Saric (1967).

e. *NPK determination*:

The chemical analysis was carried out on dried leaves samples obtained from the different treatments for the determination of nitrogen, phosphorus and potassium% as described by A.O.A.C. (1990).

f. *Essential oil GC/MS analysis*: The Central Laboratory of the National Research Center in Giza performed *GC/MS* analyses on oil samples from the experiment's two seasons. Aromatic oil The Hewlett-Packard 5890 A series 11 instrument utilized for the GC/Mass analysis was equipped with a flame ionization detector (FID) and a carbon wax fused silica column (50 m x 0.25 mm. i.d., film thickness 0.32 m). After holding at 50 Co for 3 minutes, the temperature of the column was raised to 60 Co at a rate of 3.0 Co per minute, and then it was held at 260 Co for 5 minutes. By comparing their retention durations and mass, the volatile oil components were located.

Statistical analysis

According to Snedecor and Cochran's (1980) method, the obtained data were statistically analyzed using analysis of variance. For comparing the difference between treatment means, Duncan's multiple range was employed at the 0.05 level of probability.

3. RESULTS

Growth parameters

The information in Tables 3 and 4 along with Figures 1 and 2 illustrated the impact of fertilizing with compost manure, spraying with methyl jasmonate and potassium silicate, and their interaction on the growth characteristics of sweet basil, including plant height, number of branches/plant, fresh weight of herb/plant, and dry weight of herb/plant for both cuts. In terms of the primary impact of compost manure, the results clearly showed that increasing compost manure rates up to 6.0 ton ha^{-1} had a significantly increased on all studied sweet basil plant growth in both seasons and cuts. The relative increases in plant height, number of branches/plant, fresh weight of herb/plant, and dry weight of herb/plant as a result of adding 6.0 ton ha^{-1} were 7.82, 20.98, 6.82, and 7.18%, respectively. The same patterns were observed in the second cut and in the second season.

TABLE 3. Effects of fertilizing basil plants with compost manure, potassium silicate, and methyl jasmonate sprays, as well as their interactions, on plant height and branches/plant number.

Compost ton/ha	Stimulants	Plant height (cm)				No. of branches/plant			
		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	52.3 g	50.1 g	54.7 g	52.2 g	6.1 g	7.3 ef	6.3 h	7.0 h
	MJ 20	54.7 ef	52.7 ef	55.9 ef	53.7 ef	6.2 g	7.5 e	6.6 g	7.2 h
	MJ 30	55.9 e	53.3 e	57.1 e	55.2 e	6.5 f	7.7 de	6.7 g	7.5 g
	KS 1000	53.6 f	52.0 f	55.1 f	53.8 f	6.7 ef	8.3 bc	6.5 g	7.8 f
	KS 2000	54.8 e	53.4 e	56.3 e	54.5 e	6.9 e	8.5 b	7.2 ef	8.1 e
4	0.0	55.7 de	53.6 de	56.1 de	54.8 de	7.2 d	7.5 e	7.4 e	7.9 ef
	MJ 20	57.1 c	55.3 c	59.5 c	53.9 c	7.6 c	7.7 de	7.8 d	8.4 d
	MJ 30	58.4 bc	56.9 bc	62.3 bc	54.4 bc	7.8 bc	7.9 d	8.1 c	8.7 c
	KS 1000	56.0 d	54.7 d	58.7 d	52.6 d	8.1 ab	8.6 ab	8.4 ab	9.0 ab
	KS 2000	57.4 c	56.0 c	60.2 c	54.5 c	8.4 a	8.8 a	8.6 a	9.2 a
6	0.0	56.1 cd	55.0 cd	58.8 cd	56.6 cd	7.8 c	7.7 de	8.1 c	8.6 c
	MJ 20	59.7 b	56.9 b	61.2 b	60.3 b	8.0 b	7.9 d	8.4 b	9.0 b
	MJ 30	61.1 a	60.3 a	63.6 a	62.1 a	8.2 b	8.3 b	8.6 b	9.2 b
	KS 1000	58.7 b	56.4 b	61.7 b	59.3 b	8.5 a	9.0 a	8.8 a	9.5 a
	KS 2000	58.7 b	56.3 b	61.8 b	59.2 b	8.5 a	9.0 a	8.8 a	9.4 a
Mean of compost	2	54.26 c	52.30 c	55.82 c	53.88 c	6.48 c	7.86 c	6.66 c	7.52 c
	4	56.92 b	55.30 b	59.36 b	54.04 b	7.82 b	8.10 b	8.06 b	8.64 b
	6	58.86 a	56.98 a	61.42 a	59.50 a	8.20 a	8.38 a	8.54 a	9.14 a
Mean of stimulant	0.0	54.70 e	52.90 e	56.53 e	54.53 e	7.03 e	7.50 e	7.27 e	7.83 e
	MJ 20	57.17 b	54.97 b	58.87 b	55.97 b	7.27 d	7.70 d	7.60 d	8.20 d
	MJ 30	58.47 a	56.83 a	61.00 a	57.23 a	7.50 c	7.97 c	7.80 c	8.47 c
	KS 1000	56.10 d	54.37 d	58.50 d	55.23 d	7.77 b	8.63 b	7.90 b	8.77 b
	KS 2000	56.97c	55.23 c	59.43 c	56.07 c	7.93 a	8.77 a	8.20 a	8.90 a

The considerable impact of stimulants on basil plant height, number of branches/plant, fresh and dried weights of herb/plant throughout the 2021 and 2022 seasons is shown in Tables 3 and 4. When plants received foliar treatments of potassium silicate 2000 ppm, the highest values of branches/plant and maximum values of fresh and dry weights of herb/plant were noted. On the other hand, untreated plants exhibit the lowest characteristics during both seasons. Except for the characteristics of plant height, the preference for the treatment was 30 ppm of methyl jasmonate.

In both the 2021 and 2022 growing seasons, the interaction between the fertilization of compost manure and the spraying of methyl jasmonate and potassium silicate significantly affected the plant height, number of branches, fresh weight, and dry weight of plant^{-1} of sweet basil. The application of 6.0 tons of compost manure per hectare along with foliar spraying of 2000 ppm K-silicate on sweet basil plants resulted in the highest levels of these features being measured number of branches, fresh weight, and dry weight of plant^{-1}. The highest value of plant height was only recorded when sweet basil plants were given 6.0 tons of compost manure per hectare while being sprayed with 30 ppm methyl jasmonate by foliar application. The lowest values, on the other hand, came from 2.0 tons of compost per hectare under no stimulant conditions over both growing seasons.

TABLE 4. Effect of compost manure fertilization, along with sprayingofmethyl jasmonate and potassium silicate, as well as their interaction in terms of fresh weight and dry weight of herb per plant in basil plants.

Compost ton/ha	Stimulants	Fresh weight g/plant				Dry weight g/plant			
		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	185.19 e	193 e	200 e	205 e	51.3 e	53.7 e	55.5 e	56.8 e
	MJ 20	193.86 d	198 d	202 d	209 d	53.7 d	54.9 d	56.1 d	57.9 d
	MJ 30	199.27 c	206 c	212 c	214.80 c	55.2 c	57.1 c	58.9 c	59.5 c
	KS 1000	208.30 b	212 b	216.96 b	225.26 b	57.7 b	58.9 b	60.1 b	62.4 b
	KS 2000	213.71 a	220.21 a	228.51 a	231.04 a	59.2 a	61.0 a	63.3 a	64.0 a
4	0.0	193.50 d	197.83 e	199.99 e	205.05 e	53.6 e	54.8 e	55.4 e	56.8 e
	MJ 20	201.44 c	207.94 d	209.02 d	211.91 d	55.8 d	57.6 d	57.9 d	58.7 d
	MJ 30	205.77 c	212.63 c	213.71 c	222.02 c	57.0 c	58.9 c	59.2 c	61.5 c
	KS 1000	212.63 b	215.52 b	224.90 b	230.68 b	58.9 b	59.7 b	62.3 b	63.9 b
	KS 2000	221.29 a	224.54 a	233.57 a	239.34 a	61.3 a	62.2 a	64.7 a	66.3 a
6	0.0	202.52 d	208.66 d	212.63 d	213.71 c	56.1 c	57.8 e	58.9 e	59.2 c
	MJ 20	208.66 c	214.43 c	220.21 c	226.35 b	57.8 b	59.4 d	61.0 d	62.7 b
	MJ 30	211.91 b	220.93 b	225.26 b	228.87 b	58.7 b	61.2 c	62.4 c	63.4 b
	KS 1000	225.24 a	236.87 a	239.73 a	249.59 a	61.9 a	64.4 b	65.3 b	68.2 a
	KS 2000	225.26 a	237.54 a	240.79 a	250.90 a	62.4 a	65.8 a	66.7 a	69.5 a
Mean of compost	2	200.07 c	206.20 c	212.20 c	217.03 c	55.42 c	57.12 c	58.78 c	60.12 c
	4	206.93 b	211.69 b	216.24 b	221.80 b	57.32 b	58.64 b	59.90 b	61.44 b
	6	214.72 a	223.69 a	227.72 a	233.88 a	59.40 a	61.70 a	62.90 a	64.60 a
Mean of stimulant	0.0	193.74 e	200.12 e	204.33 e	207.94 e	53.70 e	55.40 e	56.60 e	57.60 e
	MJ 20	201.32 d	206.85 d	210.58 d	215.76 d	55.80 d	57.30 d	58.30 d	59.80 d
	MJ 30	205.65 c	213.23 c	217.20 c	221.90 c	57.00c	59.10 c	60.20 c	61.50 c
	KS 1000	215.39 b	221.67 b	227.20 b	235.18 b	59.50 b	61.00 b	62.57 b	64.83 b
	KS 2000	220.09 a	227.43 a	234.29 a	240.43 a	61.00 a	63.00 a	64.90 a	66.60 a

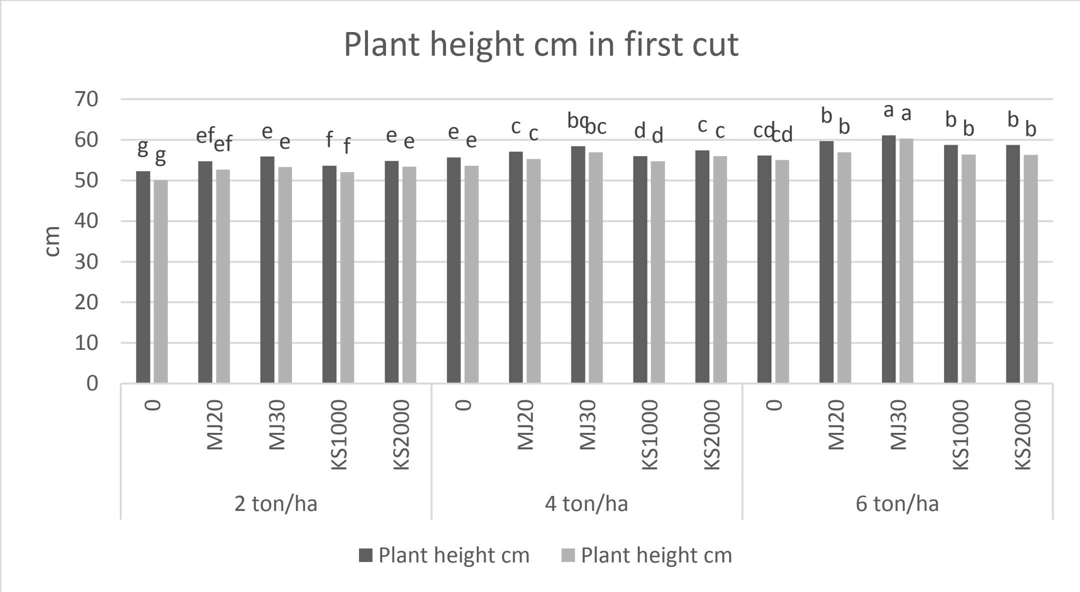

Fig. 1. Effects of fertilizing basil plants with compost manure, potassium silicate, and methyl jasmonate sprays, as well as their interactions, on plant height 2021.

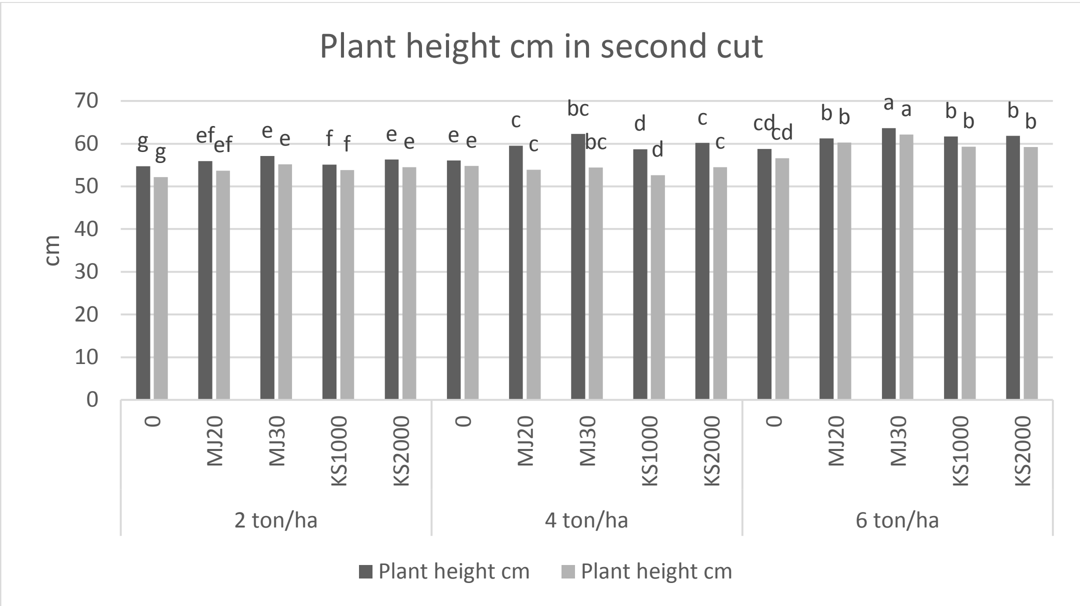

Fig. 2. Effects of fertilizing basil plants with compost manure, potassium silicate, and methyl jasmonate sprays, as well as their interactions, on plant height 2022.

Yield parameters

As shown in Table 5, fertilizing with compost manure, spraying with methyl jasmonate and potassium silicate, and their interactions all have an impact on the yields of sweet basil in terms of fresh herb yield per ha and dry herb yield per ha.The yields of fresh and dry herbs significantly increased when the amount of compost manure was raised from 2.0 to 6.0 tons ha^{-1} in both cuts and seasons, according to the findings. When compared to 2.0 tons/ha, the addition of fresh and dry herbs to 6.0 tons ha^{-1} increased to 27.26 and 19.07%, respectively, in the first cut for the first season.

For the seasons of 2021 and 2022, Table 5 shows the significant impact of stimulants on the fresh herb yield/ha and dry herb yield/ha of basil. The maximum fresh herb yield ha^{-1} and dried herb yield ha^{-1} values were seen in plants that received foliar sprays of potassium silicate 2000 ppm. As opposed to this, untreated plants display the worst traits in both seasons. Potassium silicate enhances plant architecture by causing leaves to stand more upright.

Sweet basil's fresh herb production and dried herb yield were significantly impacted by the interaction between compost manure fertilization, methyl jasmonate, and potassium silicate spraying in both the 2021 and 2022 growing seasons. The application of 6.0 tons of compost manure per hectare of sweet basil plants along with foliar spraying of 2000 ppm K-silicate resulted in the highest values of these attributes being measured. The lowest values, however, came from 2.0 tons of compost per hectare when none of the features were stimulated during both growing seasons.

Oil yield

The effects of fertilizing sweet basil with composted manure, spraying it with potassium silicate and methyl jasmonate, and their interactions on the yield and percentage of essential oils are shown in Table 6. The main effect of the manure, which was applied at a rate of 2.0 to 6.0 tons per hectare, was a significant increase in the yield and percentage of essential oils. By adding 6.0 tons per hectare over the first cut of the first season with 2.0 tons per hectare of manure, the oil percentage and yield increased by roughly 16.13 and 36.19%, respectively. The comparable increases in the second cut for the aforementioned were 18.18% and 37.10%. Similar tendencies emerged in the second season.

TABLE 5. Effect of compost manure fertilization, along with spraying of methyl jasmonate and potassium silicate, as well as their interactionson fresh weight and dry weight of herb ton/ha.

Compost ton/ha	Stimulants	Fresh weight of herb ton/ha				Dry weight of herb ton/ha			
		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	16.81 e	19.30 d	15.51 d	17.76 c	2.84 b	3.26 c	2.62 c	3.00 b
	MJ 20	19.77 d	20.36 d	16.81 d	19.18 c	3.34 b	3.44 c	2.84 c	3.24 b
	MJ 30	21.90 c	22.37 c	20.13 c	20.48 c	3.70 b	3.78 c	3.40 b	3.46 b
	KS 1000	25.69 b	26.18 b	23.68 b	24.62 b	4.34 b	4.76 b	4.00 b	4.16 b
	KS 2000	28.45 a	29.29 a	25.79 a	26.04 a	5.82 a	6.30 a	5.54 a	5.29 a
4	0.0	21.66 c	22.61 c	19.30 c	21.90 d	3.66 b	3.82 b	3.26 b	3.70 b
	MJ 20	25.10 b	26.87 b	23.09 b	24.03 c	4.24 b	4.54 b	3.90 b	4.06 b
	MJ 30	31.49 a	32.20 a	30.31 a	31.02 b	5.32 a	5.44 b	5.12 a	5.24 a
	KS 1000	32.74 a	33.57 a	31.73 a	32.79 b	5.70 a	5.84 b	5.36 a	5.54 a
	KS 2000	34.05 a	35.14 a	33.16 a	34.82 a	6.26 a	7.12 a	5.94 a	6.22 a
6	0.0	25.45 d	28.89 d	22.14 d	23.09 d	4.30 a	4.88 b	3.74 a	3.90 b
	MJ 20	28.18 c	29.36 c	24.98 c	29.60 c	4.76 a	4.96 b	4.22 a	5.00 a
	MJ 30	31.49 b	33.38 b	29.95 b	32.32 b	5.32 a	5.64 b	5.06 a	5.46 a
	KS 1000	34.45 a	35.59 a	34.44 a	36.04 a	6.17 a	6.52 a	5.48 a	5.92 a
	KS 2000	35.24 a	36.67 a	35.51 a	37.29 a	6.46 a	7.04 a	6.00 a	6.30 a
Mean of compost	2	22.52 c	23.50 c	20.38 c	21.62 c	4.01 b	4.31 b	3.68 b	3.83 b
	4	29.01 b	30.08 b	27.52 b	28.91 b	5.04 a	5.35 a	4.72 a	4.95 a
	6	30.96 a	32.78 a	29.40 a	31.67 a	5.40 a	5.81 a	4.90 a	5.32 a
Mean of stimulant	0.0	21.31 e	23.6 e	18.98 e	20.92 e	3.60 e	3.99 d	3.21 e	3.53 c
	MJ 20	24.35 d	25.53 d	21.63 d	24.27 d	4.11 d	4.31 d	3.65 d	4.10 c
	MJ 30	28.29 c	29.32 c	26.8 c	27.94 c	4.78 c	4.95 c	4.53 c	4.72 b
	KS 1000	30.96 b	31.78 b	29.95 b	31.15 b	5.40 b	5.71 b	4.95 b	5.21 b
	KS 2000	32.58 a	33.70 a	31.49 a	32.72 a	6.18 a	6.82 a	5.83 a	5.94 a

TABLE 6. Effect of compost manure fertilization, along with spraying of methyl jasmonate and potassium silicate, as well as their interactionson essential oil% and oil yield L./ha of basil plants.

Compost ton/ha	Stimulants	Essential oil%				Oil yield L./ha			
		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	0.44 b	0.36 c	0.32 c	0.28 c	12.50 e	11.74 c	8.38 c	8.40 c
	MJ 20	0.44 b	0.36 c	0.32 c	0.28 c	14.70 d	12.38 c	9.09 c	9.07 c
	MJ 30	0.48 b	0.40 c	0.32 c	0.28 c	17.76 c	15.12 c	10.88 c	9.69 c
	KS 1000	0.60 a	0.52 b	0.48 b	0.40 b	26.04 b	24.75 b	19.20 b	16.64 b
	KS 2000	0.64 a	0.60 a	0.56 a	0.48 a	37.25 a	37.80 a	31.02 a	28.42 a
4	0.0	0.52 c	0.44 b	0.40 b	0.36 c	19.03 d	16.81 e	13.04 d	13.32 d
	MJ 20	0.52 c	0.44 b	0.36 b	0.32 c	22.05 d	19.98 d	14.04 d	12.99 d
	MJ 30	0.48 c	0.48 b	0.40 b	0.32 c	25.54 c	26.11 c	20.48 c	16.77 c
	KS 1000	0.60 b	0.52 b	0.56 a	0.48 b	34.20 b	30.37 b	30.02 b	26.59 b
	KS 2000	0.68 a	0.60 a	0.60 a	0.56 a	42.57 a	42.72 a	35.64 a	34.83 a
6	0.0	0.56 b	0.52 b	0.48 b	0.44 b	25.80 c	25.38 c	17.95 d	17.16 c
	MJ 20	0.60 b	0.52 b	0.44 b	0.44 b	26.66 c	25.79 c	18.57 d	22.00 c
	MJ 30	0.60 b	0.52 b	0.44 b	0.40 b	31.92 b	29.33 b	22.26 c	21.84 c
	KS 1000	0.68 a	0.60 a	0.60 a	0.56 a	41.90 a	39.12 a	32.88 b	33.15 b
	KS 2000	0.68 a	0.60 a	0.60 a	0.56 a	43.39 a	42.24 a	36.00 a	35.28 a
Mean of compost	2	0.52 c	0.45 c	0.40 c	0.34 b	21.65 c	20.36c	15.71 c	14.44 c
	4	0.56 b	0.50 b	0.46 b	0.34 b	28.68 b	27.20 b	22.64 b	20.90 b
	6	0.62 a	0.55 a	0.51 a	0.48 a	33.93 a	32.37a	25.53 a	25.89 a
Mean of stimulant	0.0	0.51 c	0.44 d	0.40 e	0.36 d	19.11 d	17.98 d	13.13 d	12.96 d
	MJ 20	0.52 c	0.44 d	0.37 d	0.35 d	21.14 d	19.38 d	13.9 d	14.69 c
	MJ 30	0.52 c	0.47 c	0.39 c	0.33 c	25.07 c	23.52 c	17.87 c	16.10 c
	KS 1000	0.63 b	0.55 b	0.55 b	0.48 b	34.05 b	31.41 b	27.37 b	25.46 b
	KS 2000	0.67 a	0.60 a	0.59 a	0.53 a	41.07 a	40.92 a	34.22 a	32.84 a

In Table 6, data on oil% and oil yield l/ha as modified by foliar methyl jasmonate and potassium silicate application in the two study seasons of 2021 and 2022 are provided. By altering the methyl jasmonate and potassium silicate percentages, substantial changes in oil yield and oil percentage were found in the two seasons. Results showed that, in the 2021 and 2022 seasons, without any treatments, potassium silicate at 2000 ppm delivered the highest oil output and percentage. The lowest oil yield and percentage were, however, clearly attained in the 2021 and 2022 growing seasons when basil plants were not sprayed with potassium silicate (the control treatment).

The interaction of fertilizing with compost manure, spraying with methyl jasmonate, and applying potassium silicate had a significant impact on the output and percentage of essential oils in sweet basil in both the 2021 and 2022 seasons. The highest values of these characteristics were seen when 6.0 tons of compost manure per hectare of sweet basil plants were sprayed under foliar applications of 1000 and 2000 ppm K-silicate. The lowest values, on the other hand, came from 2.0 tons of compost per hectare under no stimulant conditions over both growing seasons.

Composition of chemicals

Tables 7 and 8 provide details on the effects of fertilizing basil plants with compost manure as well as the interactions between potassium silicate, methyl jasmonate, and spraying on carotenoids, chlorophyll a, and b, as well as N%, P%, and K% in the leaves. Data clearly showed that when compost manure was increased from 2.0 to 6.0 tons per hectare, all studied chemical compositions significantly improved.

TABLE 7. Effect of compost manure fertilization, along with spraying of methyl jasmonate and potassium silicate, as well as their interactionson chlorophyll a, chlorophyll b, and carotenoids of basil plants.

Compost ton/ha	Stimulants	Chlorophyll a (mg/g)				Chlorophyll b (mg/g)				Carotenoids (mg/g)			
		2021		2022		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	2.11 c	2.17 c	1.93 c	1.97 c	0.41 c	0.43 c	0.35 b	0.38 c	0.62 a	0.64 a	0.58 c	0.61 b
	MJ 20	2.26 b	2.28 b	2.01 b	2.08 b	0.44 c	0.46 c	0.37 b	0.40 c	0.64 a	0.65 a	0.60 c	0.63 b
	MJ 30	2.31 b	2.33 b	2.13 b	2.19 b	0.46 c	0.48 c	0.40 b	0.43 c	0.67 a	0.69 a	0.64 b	0.65 b
	KS 1000	2.39 a	2.42 a	2.25 a	3.02 a	0.52 b	0.54 b	0.46 a	0.48 b	0.69 a	0.71 a	0.66 b	0.69 a
	KS 2000	2.46 a	2.48 a	2.29 a	2.08 a	0.57 a	0.59 a	0.49 a	0.53 a	0.72 a	0.73 a	0.70 a	0.72 a
4	0.0	2.22 c	2.25 c	1.99 d	2.07 d	0.43 c	0.45 c	0.38 b	0.41 a	0.64 b	0.65 c	0.62 c	0.62 d
	MJ 20	2.28 c	2.30 c	2.05 d	2.12 c	0.47 c	0.49 c	0.41 b	0.45 a	0.66 b	0.67 c	0.64 c	0.65 d
	MJ 30	2.36 b	2.38 b	2.16 c	2.18 c	0.50 c	0.53 c	0.43 b	0.48 a	0.69 b	0.72 b	0.65 c	0.70 c
	KS 1000	2.42 b	2.45 b	2.28 b	2.24 b	0.55 b	0.58 b	0.48 a	0.51 a	0.72 b	0.74 b	0.70 b	0.76 b
	KS 2000	2.52 a	2.60 a	2.40 a	2.40 a	0.61 a	0.64 a	0.50 a	0.54 a	0.78 a	0.80 a	0.75 a	0.82 a
6	0.0	2.32 a	2.34 c	2.13 c	2.17 e	0.47 b	0.49 b	0.43 b	0.46 a	0.66 c	0.68 c	0.62 c	0.71 b
	MJ 20	2.39 a	2.42 b	2.19 b	2.22 c	0.50 b	0.53 b	0.46 b	0.48 a	0.68 c	0.70 c	0.66 c	0.74 b
	MJ 30	2.42 a	2.47 b	2.20 b	2.32 b	0.56 a	0.57 b	0.49 b	0.52 a	0.72 b	0.74 b	0.70 b	0.77 b
	KS 1000	2.48 a	2.59 a	2.38 a	2.41 a	0.60 a	0.64 a	0.58 a	0.56 a	0.75 b	0.78 a	0.75 a	0.83 a
	KS 2000	2.55 a	2.60 a	2.40 a	2.42 a	0.62 a	0.64 a	0.59 a	0.57 a	0.79 a	0.81 a	0.76 a	0.84 a
Mean of compost	2	2.31 c	2.34 c	2.12 c	2.27 c	0.48 c	0.50 c	0.41 c	0.44 c	0.67 c	0.68 c	0.64 c	0.66 c
	4	2.36 b	2.40 b	2.18 b	2.20 b	0.51 b	0.54 b	0.44 b	0.48 b	0.70 b	0.72 b	0.67 b	0.71 b
	6	2.43 a	2.48 a	2.26 a	2.31 a	0.55 a	0.57 a	0.51 a	0.52 a	0.72 a	0.74 a	0.70 a	0.78 a
Mean of stimulant	0.0	2.22 e	2.25 e	2.02 e	2.07 e	0.44 e	0.46 e	0.39 e	0.41 e	0.64 e	0.66 e	0.61 e	0.65 e
	MJ 20	2.31 d	2.33 d	2.08 d	2.14 d	0.47 d	0.49 d	0.41 d	0.44 d	0.66 d	0.67 d	0.63 d	0.67 d
	MJ 30	2.36 c	2.39 c	2.16 c	2.23 c	0.51 c	0.53 c	0.44 c	0.48 c	0.69 c	0.72 c	0.66 c	0.71 c
	KS 1000	2.43 b	2.49 b	2.30 b	2.56 b	0.56 b	0.59 b	0.51 b	0.52 b	0.72 b	0.74 b	0.70 b	0.76 b
	KS 2000	2.51 a	2.56 a	2.36 a	2.30 a	0.60 a	0.62 a	0.53 a	0.55 a	0.76 a	0.78 a	0.74 a	0.79 a

Information on the effects of foliar spraying with potassium silicate and methyl jasmonate on chlorophyll a, chlorophyll b, carotenoids, N%, P%, and K% over the two research seasons of 2021 and 2022 is provided in Tables 7 and 8. Changes in the potassium silicate and methyl jasmonate percentages resulted in notable changes in the two seasons for chlorophyll a, chlorophyll b, carotenoids, N%, P%, and K%. Results showed that without any treatments, potassium silicate at 2000 ppm produced the highest levels of carotenoids, N%, P%, and K% in the 2021 and 2022 seasons. However, the basil plants' levels of chlorophyll a, chlorophyll b, carotenoids, N%, P%, and K% were obviously lowest during the 2021 and 2022 growing seasons when they were not sprayed (the control treatment).

Chlorophyll a, chlorophyll b, and carotenoids in the leaves of sweet basil were significantly affected by the interaction between compost manure fertilization, potassium silicate spraying, and spraying of methyl jasmonate and other chemicals in the 2021 and 2022 growing seasons. Except for N%, P%, and K% in the leaves of sweet basil were not significant. When sweet basil plants were given 6.0 tons of compost manure per hectare along with 1000 and 2000 ppm of K-silicate foliar spray, the highest values of these features were discovered. The lowest values, however, were obtained when 2.0 tons of compost per hectare were grown without the use of stimulants over both growing seasons.

Oil composition

By using gas chromatography, the essential oil of sweet basil plants from various treatments was examined. The information in Table 9 showed how the composition of the sweet basil oil was altered by the application of compost manure fertilizer, spraying with methyl jasmonate and potassium silicate, and their interaction, specifically the percentages of 1,8-cineol, linalool, methyl chavicol, and eugenol for both cuts. Increased compost manure rates up to 6.0 tons ha^{-1} had a noticeably stronger impact on the development of all tested sweet basil plants in terms of seasons and cuttings, according to the findings of the compost manure's primary effect. In response to the addition of 6.0 tons of ha^{-1}, the proportional increases in 1,8-cineol%, linalool%, methyl chavicol%, and eugenol% were 18.74, 18.76, 18.63, and 18.80%, respectively. Both the second cut and the second season showed the same trends.

TABLE 8. Effect of compost manure fertilization, along with spraying of methyl jasmonate and potassium silicate, as well as their interactionson nitrogen, phosphorus, and potassium% of basil plants.

Compost ton/ha	Stimulants	N%				P%				K%			
		2021		2022		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	1.20	1.36	1.13	1.17	0.15	0.17	0.11	0.15	1.02	1.11	0.97	1.03
	MJ 20	1.21	1.35	1.13	1.17	0.15	0.17	0.11	0.15	1.03	1.13	0.97	1.04
	MJ 30	1.21	1.36	1.14	1.16	0.16	0.18	0.12	0.14	1.03	1.15	0.98	1.03
	KS 1000	1.47	1.52	1.40	1.35	0.19	0.21	0.15	0.13	1.23	1.34	1.00	1.05
	KS 2000	1.53	1.70	1.48	1.41	0.22	0.23	0.18	0.15	1.37	1.39	1.03	1.09
4	0.0	1.39	1.47	1.31	1.28	0.18	0.19	0.15	0.13	1.18	1.20	1.01	1.04
	MJ 20	1.38	1.48	1.32	1.27	0.17	0.20	0.15	0.13	1.19	1.23	1.01	1.05
	MJ 30	1.38	1.47	1.32	1.28	0.18	0.19	0.16	0.12	1.20	1.22	1.02	1.04
	KS 1000	1.69	1.80	1.61	1.54	0.23	0.24	0.19	0.16	1.44	1.55	1.13	1.26
	KS 2000	1.80	1.96	1.74	1.62	0.25	0.27	0.21	0.18	1.60	1.72	1.20	1.41
6	0.0	1.56	1.55	1.49	1.40	0.20	0.22	0.17	0.14	1.29	1.39	1.12	1.42
	MJ 20	1.57	1.56	1.50	1.41	0.20	0.23	0.17	0.14	1.28	1.40	1.13	1.42
	MJ 30	1.57	1.55	1.50	1.41	0.19	0.23	0.18	0.14	1.26	1.38	1.12	1.43
	KS 1000	1.87	1.97	1.76	1.70	0.25	0.28	0.22	0.20	1.60	1.66	1.40	1.56
	KS 2000	1.94	2.11	1.85	1.81	0.28	0.30	0.24	0.22	1.85	1.85	1.50	1.63
Mean of compost	2	1.32 c	1.46 b	1.26 c	1.25 c	0.17 b	0.19 c	0.13 c	0.14 b	1.14 c	1.22 c	0.99 c	1.05 c
	4	1.53 b	1.64 a	1.46 b	1.40 b	0.20 a	0.22 b	0.17 b	0.14 b	1.32 b	1.38 b	1.07 b	1.16 b
	6	1.70 a	1.75 a	1.62 a	1.55 a	0.22 a	0.25 a	0.20 a	0.17 a	1.46 a	1.54 a	1.25 a	1.49 a
Mean of stimulant	0.0	1.38 b	1.46 c	1.31 b	1.28 b	0.18 c	0.19 c	0.14 c	0.14 c	1.16 c	1.23 c	1.03 c	1.16 c
	MJ 20	1.39 b	1.46 c	1.32 b	1.28 b	0.17 c	0.20 c	0.14 c	0.14 c	1.17 c	1.25 c	1.04 c	1.17 c
	MJ 30	1.39 b	1.46 c	1.32 b	1.28 b	0.18 c	0.20 c	0.15 c	0.13 c	1.16 c	1.25 c	1.04 c	1.17 c
	KS 1000	1.68 a	1.76 b	1.59 a	1.53 a	0.22 b	0.24 b	0.19 b	0.16 b	1.42 b	1.52 b	1.18 b	1.29 b
	KS 2000	1.76 a	1.92 a	1.69 a	1.61 a	0.25 a	0.27 a	0.21 a	0.18 a	1.61 a	1.65 a	1.24 a	1.38 a

With regard to the main impact of stimulants, the results clearly show that potassium silicate applied topically at a concentration of 2000 ppm resulted in the highest compositional values of sweet basil oil, specifically the proportions of 1,8-cineol, linalool, methyl chavicol, and eugenol in the first and second cuts for both growing seasons.

TABLE 9. Effect of compost manure fertilization, along with spraying of methyl jasmonate and potassium silicate, as well as their interactions on essential oil composition % of basil plants.

Compost ton/ha	Stimulants	1,8-Cineol (%)				Linalool (%)			
		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	11.37	10.14	8.34	8.03	35.26	32.23	27.84	24.85
	MJ 20	11.37	10.14	8.34	8.03	35.26	32.23	27.84	24.85
	MJ 30	12.40	11.26	8.34	8.03	38.47	35.81	27.84	24.85
	KS 1000	15.50	14.64	12.50	11.46	48.08	46.55	41.75	35.50
	KS 2000	16.54	16.90	14.59	13.76	51.29	53.71	48.71	42.60
4	0.0	13.44	12.39	10.42	10.32	41.67	39.39	34.79	31.95
	MJ 20	13.44	12.39	9.38	9.17	41.67	39.39	31.31	28.40
	MJ 30	12.40	13.52	10.42	9.171	38.47	42.97	34.79	28.40
	KS 1000	15.50	14.64	14.59	13.76	48.08	46.55	48.71	42.60
	KS 2000	17.57	16.90	15.63	16.05	54.50	53.71	52.19	49.70
6	0.0	15.50	14.64	12.50	12.61	48.08	46.55	41.75	39.05
	MJ 20	14.47	14.64	11.46	12.61	44.88	46.55	38.27	39.05
	MJ 30	15.50	14.64	11.46	11.46	48.08	46.55	38.27	35.50
	KS 1000	17.57	16.90	15.63	14.90	54.50	53.71	52.19	46.15
	KS 2000	19.64	19.15	16.67	17.20	60.91	60.88	55.67	53.25
Mean of compost	2	13.44 c	12.62 c	10.42 c	9.86 c	41.67 c	40.11 c	34.80 c	30.53 c
	4	14.47 b	13.97b	12.09 b	11.69 b	44.88 b	44.40 b	40.36 b	36.21 b
	6	16.54a	15.99a	13.54 a	13.76 a	51.29 a	50.85 a	45.23 a	42.60 a
Mean of stimulant	0.0	13.44 c	12.39 d	10.42 c	10.32 c	41.67 c	39.39 c	34.79 d	31.95 c
	MJ 20	13.09 c	12.39 d	9.72 c	9.94 c	40.60 c	39.39 c	32.47 c	30.77 c
	MJ 30	13.43 c	13.14 c	10.07 c	9.55 c	41.67 c	41.78 c	33.63 c	29.58 c
	KS 1000	16.19b	15.39 b	14.24 b	13.37 b	50.22 b	48.94 b	47.55b	41.42 b
	KS 2000	17.92a	17.65 a	15.63 a	15.67 a	55.57 a	56.10 a	52.19 a	48.52 a

Compost ton/ha	Stimulants	Methyl chavicol (%)				Eugenol (%)			
		2021		2022		2021		2022	
		First cut	Second cut	First cut	Second cut	First cut	Second cut	First cut	Second cut
2	0.0	2.51	2.33	1.67	1.80	4.68	4.24	3.93	3.47
	MJ 20	2.51	2.33	1.67	1.79	4.68	4.24	3.93	3.47
	MJ 30	2.74	2.59	1.67	1.79	5.11	4.71	3.93	3.47
	KS 1000	3.42	3.37	2.51	2.56	6.38	6.12	5.89	4.95
	KS 2000	3.65	3.89	2.93	3.08	6.81	7.06	6.87	5.94
4	0.0	2.96	2.85	2.09	2.31	5.53	5.18	4.91	4.46
	MJ 20	2.96	2.85	1.88	2.05	5.53	5.18	4.42	3.96
	MJ 30	2.74	3.11	2.09	2.05	5.11	5.65	4.91	3.96
	KS 1000	3.42	3.37	2.93	3.08	6.38	6.12	6.87	5.94
	KS 2000	3.88	3.89	3.14	3.59	7.24	7.06	7.36	6.93
6	0.0	3.42	3.37	2.51	2.82	6.38	6.12	5.89	5.45
	MJ 20	3.19	3.37	2.30	2.82	5.96	6.12	5.40	5.45
	MJ 30	3.42	3.37	2.30	2.56	6.38	6.12	5.40	4.95
	KS 1000	3.88	3.89	3.14	3.33	7.24	7.06	7.36	6.44
	KS 2000	4.33	4.41	3.35	3.85	8.09	8.00	7.85	7.43
Mean of compost	2	**2.97 c**	**2.90 c**	**2.09 c**	**2.20 c**	**5.53 c**	**5.27 c**	**4.91 c**	**4.26 c**
	4	**3.19 b**	**3.21 b**	**2.43 b**	**2.62 b**	**5.96 b**	**5.84 b**	**5.69 b**	**5.05 b**
	6	**3.65 a**	**3.68 a**	**2.72 a**	**3.08 a**	**6.81 a**	**6.68 a**	**6.38 a**	**5.94 a**
Mean of stimulant	0.0	**2.96 c**	**2.85 d**	**2.09 d**	**2.31 c**	**5.53 c**	**5.18 d**	**4.91 d**	**4.46 d**
	MJ 20	**2.89 c**	**2.85 d**	**1.95 c**	**2.22 c**	**5.39 d**	**5.18 d**	**4.58 d**	**4.29 d**
	MJ 30	**2.97 c**	**3.02 c**	**2.02 c**	**2.13 c**	**5.53 c**	**5.49 c**	**4.75 c**	**4.13 c**
	KS 1000	**3.57 b**	**3.54 b**	**2.86 b**	**2.99 b**	**6.67 b**	**6.43 b**	**6.71 b**	**5.78 b**
	KS 2000	**3.95 a**	**4.06 a**	**3.14 a**	**3.51 a**	**7.38 a**	**7.37 a**	**7.36 a**	**6.77 a**

In particular, the percentages of 1,8-cineol, linalool, methyl chavicol, and eugenol in the sweet basil oil in both the 2021 and 2022 seasons were not significantly affected by the interaction between compost manure fertilization, coupled with a spraying of methyl jasmonate and potassium silicate. The highest values of these characteristics were seen when 6.0 tons of compost manure per hectare of sweet basil plants were sprayed under foliar applications of 1000 and 2000 ppm K-silicate. The lowest values, on the other hand, came from 2.0 tons of compost per hectare under no stimulant conditions over both growing seasons.

4. Discussion

The research concerned with the sustainability of food system all over the world has recently received modern boost due to the report published by Willett*et al*. (2019), who stated that the modern global food system needs a new agricultural revolution that depended on sustainable intensification and occur by sustainability and new system. In this concentration, environmental consciousness and healthy life are very important now a day by increase the naturel feeding. Ceylan *et al*. (2020) mentioned that organic fertilizer is important for crop production and agriculture sustainability as well as soil fertility. Beside its agricultural input is used in organic farming, which preferred for friendly environment and healthy life.

One objective of this work was to compare the effectiveness of different rates of compost on vegetative growth, yield parameters, oil yield and oil composition of sweet basil. The results recorded that increasing compost rate improve all studied sweet basil productivity parameters. The beneficial effect of compost on vegetative growth of sweet basil is mainly due to the fact that adding organic manure to the soil encourages the activity of microorganisms, which improves the production of auxin and growth promoting substances to the root zone (Yaldiz*et al*., 2019 and Saikiaand Upadhyaya, 2011). In addition, microorganisms can also directly boost plant growth by producing phytohormones (Glick, 2003). Furthermore, incorporating organic manure improves soil properties, resulting in increased nutrient availability. In this regard, Hemmat*et al*. (2010) linked the increase to the high OM rate of manure and compost, as well as its form and fraction size. Similarly, when compared to the control soil, the increased base saturation of the amended soil reflected improved soil fertility and nutrient retention capacity.These findings are consistent with those made by many authors who declared that organic fertilization improved herb fresh and dry yields of sweet basil such as El-Naggar *et al*. (2015) and El-Sheref*et al*. (2019).

As for the oil yield, the positive effect of compost manure on oil yield can be explain by the fact that the biological and physiological effects of organic manure on vegetative growth features, prevention of nitrogen losses, and better soil chemical and physical qualities may be the reason why oil % and yield have improved when compost manure levels have been increased (Taiwo *et al*., 2002). These findings concur with those made by El-Omar *et al*. (2018), who claimed that organic manure increased basil plants' oil percentage and oil yield.The lowest oil yield and percentage were, however, clearly attained in the 2021 and 2022 growing seasons when basil plants were not sprayed with potassium silicate (the control treatment). Variations in silicate levels and foliar spray, which may have reduced photosynthate consumption while enhancing photosynthesis and facilitating the movement of assimilates from photosynthesis, improved the physiological process (Shashidhar *et al*., 2008).The chemical composition of sweet basil was improved due to increasing compost rates up to 6.0 tons/ha which may be attributed to adding organic manure encouraged the growth of several beneficial microorganisms, which improved the production of auxin and growth-promoting substances in the root zone, thereby promoting nutrient absorption and pigment formation (El-Merich*et al*., 1997). These findings are comparable to those made by Eid and Kassem (2009) for the concentration of N, P, and K, and Abd El-Salam (2014) for the concentration of chlorophyll a, chlorophyll b, and carotenoids.The effect of compost on proportional increases of 1,8-cineol, linalool, methyl chavicol, and eugenol may be due to the direct effect of compost manure or the indirect effect of environmental conditions, especially temperature and light period on the physiological and biochemical processes in the plants consequently oil percentage that reflects on oil yield and composition (Sirousmehr*et al*., 2014).

A second aim of this work was to evaluate the effect of foliar spraying of some stimulants such as 20 and 30 ppm methyl jasmonate, and 1000 and 2000 ppm potassium silicate as comparing with control on the abovementioned sweet basil parameters. Except for plant height, it could be arranged the effectiveness of the studied stimulants on sweet basil productivity on the descending order: 0.0 > 20 ppm methyl jasmonate > 30 ppm methyl jasmonate > 1000 ppm potassium silicate > 2000 ppm potassium silicate. It worthy to mentioned that for higher plants, silicon has not been considered as essential nutrient, but it has a beneficial effect on growth of many crops. Ma *et al*. (2001) reported that applied silicon salts to plants in several countries increased crop production. Also. Silicon mitigates the adverse effect of water, deficiency of nutrients (Abou-Baker *et al*., 2011) and eliminate the adverse effect of biotic stresses including salinity hazard, nutrient imbalance and mineral toxicity (Ma, 2004). In addition, potassium silicateenhances plant architecture by causing leaves to stand more upright. This increases the amount of light that the tested plants' leaves can absorb, which leads to an increase in the rate of photosynthetic activity. The increased rate of photosynthetic activity results in an increase in NADP and NADPH as coenzymes, which improves the biological process and, as a result, results in a higher capacity for assimilating nitrogen and more dry weight buildup (Taiz and Zeiger, 2010).

As for the superiority of potassium silicate, Dastan *et al*. (2011) stated that the positive effect of potassium silicate on chemical composition of basil plant may be attributed to its increased leaf water potential, increased nutrient bioavailability, increased antioxidant, elevated growth hormones and regulators, decreased transpiration rate, increased rate of photosynthesis, improved cell membrane stability, increased energy compound, and encouragement of cell division and elongation. Potassium silicate's high nutritional content results in high concentrations of gibberellic acid (GA3) and indole acetic acid (IAA), which enhanced cell division and caused the panicle axel to elongate, resulting in a lengthy panicle. Moreover, silica promotes the release of copious Abscisic Acid (ABA), which inhibits panicle activity by limiting the lengthening and division of the panicle peduncle. Adding silica might boost the formation of IAA and GA3, while decreasing the formation of ABA. The current results are fairly consistent with those published by Dastan *et al*. (2011). The positive response of oil percent and yield to potassium silicate may be due to Si may have a significant role in the creation of secondary metabolites that are produced more quickly as a result of an elicitor, and these secondary metabolites may cause various transcriptional changes. The increased essential oil composition through potassium silicate treatment up to 2000ppm may also enhance cell development, and ion uptake, or modify leaf oil gland density (Esmaeilzadeh and Rezaei, 2018). This result is in line with previous studies that demonstrate the use of silicon improving essential oil accumulation (Farouk and Omar, 2020).

It is obvious to observed that methyl jasmonate application have a positive effect only on plant height when compared with K-silicate, which mainly due to methyl jasmonate consider the plant growth harmony, consequently act only on cell elongation.This outcome is explicable many physiological and biochemical processes in plants, including tendril coiling, pollen viability, tuber formation, organogenesis, male fertility, defense reactions, fruit ripening, and ethylene production, are regulated by a plant hormone called jasmonic acid (An *et al*. 2019; Asghari *et al*. 2020; and Abeed *et al*. 2021).

Finally, the most favorable treatment for sweet basil productivity was added 6.0 tons/ha compost and foliar spraying of 2000 ppm K-silicate.

5. Conclusions

Accordingly, it could be concluded that increasing compost manure rates up to 6.0tons ha^{-1} was the most effective in increasing the vegetative growth, yield, oil yield, and chemical composition of sweet basil. This is due to the lack of nutrients and organic matter in the sandy soil condition. Adding compost fertilizer in a larger quantity from 2.0 up to 6.0 tons/ha gives positive results on the growth and yield of sweet basil. The foliar treatments of 2000 ppm K-silicate combined with 6.0 tons of compost manure per hectare of sweet basil plants produced the greatest levels of these traits under the condition of Ismailia governorate, Egypt.

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