Assessment of Micronutrient Status in Jasmine (*Jasminumazoricum* L.) Growing Soils of HuvinaHadagaliTaluk, Vijayanagara District of Karnataka, India

ABSTRACT

The present study was conducted during winter (November-December, 2022) in Jasmine growing area of HuvinaHadagaliTaluk, Vijayanagara District to assess the soil micronutrient statusin Jasmine growing areaand analysed for their fertility parameters. A total of 60 soil samples were collected, of which 30 surface (0–20 cm) and 30 subsurface (20–40 cm) soil depths covering six villages namely Huvinahadagali, Hanakanahalli,Vinobhanagara,Meerakornahalli, Devagondanahalli andThippapura. In surface soil, available micronutrients boron, zinc, iron, copper and manganese ranged from 0.45 to 1.28, 0.24 to 0.98, 1.17 to 7.90, 0.30 to 3.76 and 2.44 to 22.52 mg kg^{-1}, respectively. Mean soil pH was 7.96, mean soluble salt was 0.27 dS m^{-1} and soil organic carbon ranged from 2.40 to 6.80 g kg^{-1}. In subsurface soil, available micronutrients boron, zinc, iron, copper and manganese ranged from 0.36 to 1.09, 0.16 to 0.80, 0.96 to 6.76, 0.16 to 2.72 and 1.84 to 20.86 mg kg^{-1}, respectively. Mean soil pH was 8.06, mean soluble salt was 0.32 dS m^{-1} and soil organic carbon ranged from 1.60 to 6.00 g kg^{-1}. The results showed thatdepending on the nutrient nature, their concentration was either found in the range of deficit, or sufficient or in excessdue to poor nutrient management practices like continuous use of chemical fertilizers and less use of organics which results in poor soil fertility leading to low yield and low quality of Jasmine flowers.

Key words:Jasmine, Micronutrient, Nutrient status, Soil

1. Introduction

Floriculture is a vital sub-sector of horticulture, having potential for providing employment opportunities to farmers especially small and marginal farmers (Kaviarasan et al., 2015). Jasmine is an important flower crop cultivated for its loose flowers. The flowers is used largely in all religious, social and cultural ceremonies performed by people of all faiths and religion. Jasmine flowers are used for making garlands and Essential oils are extracted from the flowers which has vast export potential (Latha and Pichumani, 2018). HadagaliMallige (*Jasminumazoricum)* which belongs to the family *Oleaceae* is native to India or South East Asia. Locally known as “VasaneMallige", (fragrant Jasmine), it is grown mainly in HuvinaHadagalitaluk (Sharanabasava et al., 2023).In India total jasmine is grown in an area of 26.15 thousand hectares with production of 237.74 thousand metric tonnes. In Karnataka, jasmine is grown in an area of 3.13 thousand hectares with production of 23.18 thousand metric tonnes (Anonymous, 2021). Karnataka stands second in terms of production after Tamil Nadu (Anonymous, 2022).

Jasmine is inhaled to improve mood, reduces stress and reduce food cravings. In foods, Jasmine is used to flavour beverages, frozen dairy desserts, candy etc. Also used as an aphrodisiac, a sedative, an antiseptic, antidepressant, antispasmodic, and analgesic. In Ayurveda, Jasmine has been used as an aphrodisiac and as a means to increase immunity and fight fever. It has also been regarded as a means to treat conjunctivitis (Sudheer et al.,2018). In traditional Chinese medicine, Jasmine flowers are brewed and consumed as herbal and remedial tea. An infusion of Jasmine tea is known to be beneficial in treating fever, urinary inflammation, and other infections. In addition, Jasmine tea can be helpful in relieving stress and anxiety. It can be extremely helpful for people suffering from heat stroke or sunstroke (Anshuman and Vyas, 2018).

Soil fertility is one of the important factors that control crop yields. Soil characterization of an area in relation to their soil fertility status is important for sustainable agricultural production (Dhanve et al., 2018). Introduction of high yielding varieties in Indian agriculture encouraged the farmers to apply nutrients through fertilizers. However, production response efficiency to fertilizer nutrients declined significantly over the last few decades. Imbalanced and inadequate fertilizer use without micronutrients can affect crop productivity and soil health (Bangre et al., 2020).

The successful cultivation of jasmine is dependent on many factors such as climate, soil fertility, irrigation and other agronomic practices. Among these soil nutrients especially micronutrients have major effect on plant growth, development and yield (Sharanabasava et al., 2023).

Plants require micronutrients to complete their life cycle. Micronutrients are present in the soil in large quantitiesbut only a small quantity is required as a nutrient. These micronutrients play an important role in enzymatic activity and regulate metabolic activities. Zinc helps in synthesizing various enzymes, chlorophyll formation and functional, structural components like protein synthesis, photosynthesis and synthesis of auxin(Zeng et al., 2021). Boron one of the most important inorganic micronutrients, plays a vital role in normal plant growth (Vera et al., 2019), enhanced quality of crops (Souri and Hatamian, 2019).Iron is essential for chlorophyll formation, protein synthesis and also involved in various metabolic reactions. Magnesium is the main constitute of chlorophyll and helps in the uptake of phosphorus (Kuldeep Kumar et al., 2023).

Imbalanced nutrient use by farmers has resulted in aggravating the multiple nutrient deficiencies which reduces the quality and yield of Jasmine (Sharanabasava et al., 2023).Keeping these considerations in view with an objective of, to assess the soil micronutrient status in jasmine growing areas.

2. Material and Methods

The present study was conducted during winter (November-December, 2022) in Jasmine growing area of HuvinaHadagaliTaluk, Vijayanagara District to assess the soil micronutrient statusin Jasmine growing areaand analysed for their fertility parameters. Huvinahadagalitaluk comes under Northern Dry agro–climatic zone-III of Karnataka state. Soils are sandy loam in texture. Study area is located at 14^0 43" N latitude, 75° 39" E longitude with an altitude of 527 m above mean sea level with an average annual rainfall of 620 mm andwith mean annual temperature of 33^0–37^0C. A study was conducted in six villages of HuvinaHadagalitalukviz., Huvinahadagali, Hanakanahalli, meerakornahalli, Vinobhanagara, Devagondanahalli and Thippapuravillege from each village five Jasmine growing farmers are selected based on largest area and more than five years of experiences in Jasmine cultivation. A total of 60 soil samples from two depth 30 surface (0–20 cm) and 30 subsurface (20–40 cm) soil samples were collected.

3. Results and Discussion

3.1 Soil pH

Soil pH was determined in 1:2.5 soil water suspension ratio. This suspension was stirred intermittently for half an hour and pH was measured by potentiometric method using glass electrode.

The pH of surface soil (0–20 cm) ranged from 7.58 to 8.35 with a mean value of7.96. The lowest pH (7.58) value was recorded in Huvinahadagali village (V_1S_3), whereas, highest pH (8.35) was recorded inVinobhanagara village (V_3S_3).Data on soil pH revealed that soils are moderately neutral to slightly alkaline in reaction. The pHinsubsurface(20–40 cm)soilsamples ranged from 7.72 to 8.39 with mean value of 8.06. The lowest pH (7.72) wasobserved in Hanakanahalli village (V_2S_2) and highest pH (8.39) was recorded inVinobhanagara village (V_3S_3). Data on soil pH revealed that soils are neutral to alkaline in reaction(Table 1). The pH has shown increasing trend with increase in soil depth, which may be due to theleaching of exchangeable bases from the surface soil to sub surface soil. Similar result were reported by Fekad et al.(2020).

3.2 Soluble salt content (dS m^{-1})

The electrical conductivity (EC) of soil was determined in 1:2.5 soil water suspension ratio using Conductivity Bridge and the results were expressed in dSm^{-1}.

A mean value of 0.27 was found for the EC of surface soil (0–20 cm), which ranged from 0.15 to 0.45 dS m^{-1}. The Huvinahadagali village (V_1S_5) had the greatest EC value(0.45 dS m^{-1}), whereas Hanakanahalli village (V_2S_3) had the lowest EC value (0.15 dS m^{-1}). Data on soil EC showed that soils are non–saline. A mean value of 0.32 dSm^{-1} was found as the EC of subsurface soil (20–40 cm), with a range of 0.18–0.62 dSm^{-1}. Huvinahadagali village (V_1S_5) had the highest EC (0.62 dS m^{-1}) whereas Vinobhanagara village (V_3S_4) recorded the lowest EC (0.18 dS m^{-1}) (Table 1). Surface and subsurface soils electrical conductivity was found to be normal. It is possible that salts were leached from the upper layers to the lower layers as a result of rainfall or irrigation and then accumulated at the lower soil depths. Similar outcomes and justifications were reported by Sathish et al. (2017).

Table 1. Status of soil reaction and soluble salt content in selected soils of Huvina Hadagali Taluk

Sl.No	Village Name	Sample Code	pH (1:2.5 soil: water)		EC (dS m^{-1})	
			Surface	Subsurface	Surface	Subsurface
1	Huvinahadagali	V_1S_1	7.88	7.96	0.21	0.25
2		V_1S_2	8.32	8.36	0.20	0.28
3		V_1S_3	7.58	7.75	0.23	0.27
4		V_1S_4	8.12	8.15	0.26	0.32
5		V_1S_5	7.85	7.99	0.45	0.62
6	Hanakanahalli	V_2S_1	7.98	8.10	0.17	0.26
7		V_2S_2	7.70	7.72	0.16	0.18
8		V_2S_3	7.60	7.91	0.15	0.20
9		V_2S_4	7.94	7.98	0.26	0.38

10		V_2S_5	8.21	8.25	0.30	0.32
11	Vinobhanagara	V_3S_1	7.90	8.23	0.28	0.35
12		V_3S_2	7.95	8.10	0.24	0.30
13		V_3S_3	8.35	8.39	0.44	0.46
14		V_3S_4	7.72	7.77	0.16	0.18
15		V_3S_5	7.80	7.92	0.23	0.35
16	Meerakornahalli	V_4S_1	7.78	7.90	0.23	0.26
17		V_4S_2	7.96	8.05	0.20	0.23
18		V_4S_3	7.63	7.85	0.18	0.19
19		V_4S_4	7.70	7.92	0.18	0.21
20		V_4S_5	8.04	8.21	0.32	0.33
21	Devagondanahalli	V_5S_1	8.33	8.36	0.25	0.27
22		V_5S_2	7.94	8.00	0.24	0.28
23		V_5S_3	8.29	8.34	0.42	0.52
24		V_5S_4	8.30	8.38	0.28	0.29
25		V_5S_5	8.22	8.30	0.34	0.37
26	Thippapura	V_6S_1	7.92	8.10	0.36	0.37
27		V_6S_2	7.79	7.82	0.22	0.24
28		V_6S_3	7.68	7.76	0.38	0.40
29		V_6S_4	8.10	8.21	0.28	0.30
30		V_6S_5	7.96	7.98	0.43	0.52
Lowest			**7.58**	**7.72**	**0.15**	**0.18**
Highest			**8.35**	**8.39**	**0.45**	**0.62**
Mean			**7.96**	**8.06**	**0.27**	**0.32**

3.3 Soil organiccarbon (g kg^{-1})

The organic carbon content in surface soil (0–20 cm) ranged from 2.40 to 6.80 g kg^{-1} with a mean of 5.00 g kg^{-1}.Huvinahadagali village (V_1S_4) had the lowest soil organiccarbon value, which was 2.40g kg^{-1}, while Huvinahadagali village (V_1S_5) and Devagondanahalli village (V_5S_5) had the highest soil organiccarbonvalues (6.80 g kg^{-1}). A mean value of 4.10 g kg^{-1} was found for the soil organiccarbon of subsurface soil (20-40 cm). The soil organiccarbonvalues ranged from 1.60 to 6.00 g kg^{-1}. Soil organiccarbon values ranged from 1.60g kg^{-1} in Vinobhanagara village (V_3S_3) to 6.00 g kg^{-1} in Devagondanahalli village (V_5S_5). Vinobhanagara village had the lowest soil organiccarbon value(Figure 1). Organic carbon content was higher in the surface soils and declined as soil depth increased. The presence of natural vegetation and addition of organic residues in surface layer results in higher organic carbon content in surface than in subsurface. Rajesh et al. (2021) provided similar evidence for these conclusions in his study.

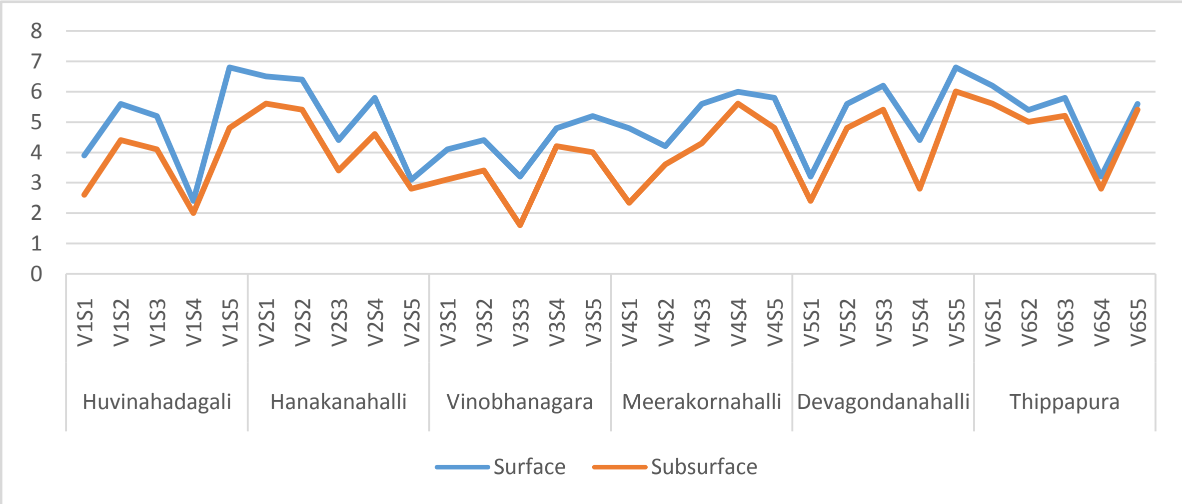

Figure 1: Organic carbon content in surface and subsurface soil

3.4 Available Boron (mg kg^{-1})

The available boron in surface soil (0–20 cm) ranged from 0.45 to 1.28mg kg^{-1} with a mean value of0.91 mg kg^{-1}. The lowest available boron (0.45mg kg^{-1}) value was recorded in Huvinahadagali village (V_1S_4), whereas highest available boron (1.28mg kg^{-1}) was recorded inHanakanahallivillage (V_2S_2).The available boron in subsurface soil (20–40 cm) ranged from 0.36 to 1.09mg kg^{-1}with a mean value of0.76mg kg^{-1}. The lowest available boron (0.36 kg ha^{-1}) value was recorded in Huvinahadagali village (V_1S_4), whereas highest available boron (1.09mg kg^{-1}) was recorded inHanakanahalli village (V_2S_2)(Table 2). The available boron content was higher in surface soil when compared with samples of subsurface soils. This might be due to accumulation of organic matter and well drained condition in the surface soilswere reported byMamta Sahuet al. (2023).

Table 2. Status of available boron in selected soils of Huvina Hadagali Taluk

Sl.No.	**Village Name**	**Sample Code**	**Available B (mg kg^{-1})**	
			Surface	**Sub-surface**
1	Huvinahadagali	V_1S_1	0.51	0.43
2		V_1S_2	1.09	0.92
3		V_1S_3	0.77	0.64
4		V_1S_4	0.45	0.36

5		V_1S_5	1.15	0.83
6	Hanakanahalli	V_2S_1	1.21	1.00
7		V_2S_2	1.28	1.09
8		V_2S_3	1.02	0.64
9		V_2S_4	1.15	0.97
10		V_2S_5	0.90	1.09
11	Vinobhanagara	V_3S_1	0.77	0.71
12		V_3S_2	1.02	0.90
13		V_3S_3	0.64	0.58
14		V_3S_4	1.15	0.61
15		V_3S_5	1.22	1.09
16	Meerakornahalli	V_4S_1	0.68	0.54
17		V_4S_2	0.64	0.51
18		V_4S_3	0.83	0.77
19		V_4S_4	1.15	1.02
20		V_4S_5	1.02	0.70
21	Devagondanahalli	V_5S_1	0.51	0.42
22		V_5S_2	0.91	0.85
23		V_5S_3	0.96	0.83
24		V_5S_4	0.58	0.50
25		V_5S_5	1.02	0.97
26	Thippapura	V_6S_1	0.98	0.84
27		V_6S_2	0.93	0.74
28		V_6S_3	0.96	0.81
29		V_6S_4	0.77	0.61
30		V_6S_5	0.94	0.81
Lowest			**0.45**	**0.36**
Highest			**1.28**	**1.09**
Mean			**0.91**	**0.76**

3.5 DTPA(Diethyl TriaminePenta Acetic acid) *extractable micronutrients (mg kg^{-1})*

Available micronutrients in soils were determined with DTPA extractant (0.5 M Diethyl TriaminePenta Acetic acid + 0.01 M $CaCl_2.2H_2O$ + 0.1 N Tri-ethanolamine buffered at pH 7.3) at 1:2 soil to extractant ratio as described by Lindsay and Norwell (1978). The soil solution was further filtered iron, manganese, zinc, copper were determined in the extract using Atomic Absorption Spectrophotometer fitted with appropriated hollow cathode lamps under specific measuring concentration as specified in the instrument manual.

$$\text{DTPA extractable micronutrients in soil (mg kg}^{-1}\text{)} = \frac{\text{ppm} \times \text{Volume of extractant} \times \text{DF} \times 10^3}{10^3 \times \text{Weight of soil sample}}$$

The result of DTPA extractable soil micronutrients, in surface (0–20 cm) and subsurface (20–40 cm) soils are presented (Table 3 & 4).

The DTPA extractable Zn in surface soil (020 cm) ranged from 0.24 to 0.98mg kg^{-1} with a mean value of0.55 mg kg^{-1}. The lowest DTPA extractable Zn (0.24 mg kg^{-1}) value was recorded in Thippapuravillag (V_6S_4), whereas highest DTPA extractable Zn (0.98 mg kg^{-1}) was recorded inThippapuravillage (V_6S_1).The DTPA extractable Zn in subsurface soil (20–40 cm) ranged from 0.16 to 0.80 mg kg^{-1} with a mean value of0.40 mg kg^{-1}. The lowest DTPA extractable Zn (0.16 mg kg^{-1}) value was recorded in Thippapura village (V_6S_4), whereas highest DTPA extractable Zn (0.80 mg kg^{-1}) was recorded inMeerakornahalli village (V_4S_4).

The DTPA extractable Fe in surface soil (0–20 cm) ranged from 1.17 to 7.90 mg kg^{-1} with a mean value of3.70 mg kg^{-1}. The lowest DTPA extractable Fe (1.17 mg kg^{-1}) value was recorded in Thippapura village (V_6S_4), whereas highest DTPA extractable Fe (7.90 mg kg^{-1}) was recorded inVinobhanagara village (V_3S_5).The DTPA extractable Fe in subsurface soil (20-40 cm) ranged from 0.9 to 6.76 mg kg^{-1} with a mean value of2.6 mg kg^{-1}. The lowest DTPA extractable Fe (0.9 mg kg^{-1}) value was recorded in Huvinahadagali village (V_1S_1), whereas highest DTPA extractable Fe (6.76 mg kg^{-1}) was recorded inVinobhanagaravillage (V_3S_5).

Table 3. Status of DTPA extractable Zn and Fecontent in selected soils of Huvina Hadagali Taluk

Sl.No.	Village Name	Sample Code	DTPA extractable Zn (mg kg^{-1})		DTPA extractable Fe (mg kg^{-1})	
			Surface	Subsurface	Surface	Subsurface
1	Huvinahadagali	V_1S_1	0.56	0.24	1.90	**0.90**
2		V_1S_2	0.64	0.56	4.18	3.74
3		V_1S_3	0.62	0.38	2.10	1.50
4		V_1S_4	0.46	0.43	1.86	1.70
5		V_1S_5	0.74	0.36	6.46	4.90
6	Hanakanahalli	V_2S_1	0.56	0.48	4.72	4.14
7		V_2S_2	0.88	0.52	5.40	2.28
8		V_2S_3	0.41	0.36	3.90	2.28

9		V_2S_4	0.54	0.33	4.42	3.92
10		V_2S_5	0.36	0.24	1.82	1.12
11	Vinobhanagara	V_3S_1	0.52	0.32	3.04	1.34
12		V_3S_2	0.56	0.26	3.36	1.86
13		V_3S_3	0.44	0.38	2.86	1.19
14		V_3S_4	0.64	0.44	6.12	5.94
15		V_3S_5	0.82	0.58	7.90	6.76
16	Meerakornahalli	V_4S_1	0.28	0.21	2.70	2.18
17		V_4S_2	0.26	0.22	2.58	1.98
18		V_4S_3	0.30	0.24	3.40	2.52
19		V_4S_4	0.82	0.80	5.90	4.10
20		V_4S_5	0.38	0.32	3.54	2.26
21	Devagondanahalli	V_5S_1	0.32	0.24	2.62	1.09
22		V_5S_2	0.72	0.58	3.48	2.06
23		V_5S_3	0.82	0.76	3.84	2.56
24		V_5S_4	0.44	0.35	2.96	1.94
25		V_5S_5	0.86	0.74	4.76	3.34
26	Thippapura	V_6S_1	0.98	0.64	4.36	3.78
27		V_6S_2	0.42	0.34	2.46	1.92
28		V_6S_3	0.46	0.32	3.70	2.32
29		V_6S_4	0.24	0.16	1.17	0.96
30		V_6S_5	0.43	0.31	3.62	3.04
Lowest			**0.24**	**0.16**	**1.17**	**0.96**
Highest			**0.98**	**0.80**	**7.90**	**6.76**
Mean			**0.55**	**0.40**	**3.70**	**2.60**

The DTPA extractable Cu in surface soil (0–20 cm) ranged from 0.3 to 3.76 mg kg^{-1} with a mean value of1.73 mg kg^{-1}. The lowest DTPA extractable Cu (0.3 mg kg^{-1}) value was recorded in Vinobhanagara village (V_3S_3), whereas highest DTPA extractable Cu (3.76 mg kg^{-1}) was recorded inHuvinahadagalivillage (V_1S_5).The DTPA extractable Cu in subsurface soil (20–40 cm) ranged from 0.16 to 2.72 mg kg^{-1} with a mean value of0.89 mg kg^{-1}. The lowest DTPA extractable Cu (0.16 mg kg^{-1}) value was recorded in Hanakanahalli village (V_2S_2), whereas highest DTPA extractable Cu (2.72 mg kg^{-1}) was recorded inHuvinahadagalivillage (V_1S_5).

The DTPA extractable Mn in surface soil (0–20 cm) was ranged from 2.44 to 22.52 mg kg^{-1} with a mean value of9.28 mg kg^{-1}. The lowest DTPA extractable Mn (2.44 mg kg^{-1}) value was recorded in Thippapura village (V_6S_4), whereas highest DTPA extractable Mn

(22.52 mg kg^{-1}) was recorded inHuvinahadagalivillage (V_1S_5).The DTPA extractable Mn in subsurface soil (20-40 cm) ranged from 1.84 to 20.86 mg kg^{-1} with a mean value of8.24 mg kg^{-1}. The lowest DTPA extractable Mn (1.84 mg kg^{-1}) value was recorded in Thippapura village (V_6S_5), whereas highest DTPA extractable Mn (20.86 mg kg^{-1}) was recorded inHuvinahadagalivillage (V_1S_5).

The surface soils showed higher content of DTPA extractable micronutrients than subsurface soils,which exhibited a decreasing trend with increase in soil depth. This might be due tohigher organic carbon at surface soils, as organic carbon is a major contributor ofDTPAzincinsoils.Thelowavailablezincwaspossiblymightbeduetocalcareousness, high pH and low organic matter which might have resulted in theformation of insoluble compounds by zinc or insoluble calcium zincate. The similartrendswas reportedbyBhatetal.(2017).

Table 4. Status of DTPA extractable Cu and Mn content in selected soils ofHuvina Hadagali Taluk

Sl. No.	Village Name	Sample Code	DTPA extractable Cu (mg kg^{-1})		DTPA extractable Mn (mg kg^{-1})	
			Surface	Subsurface	Surface	Subsurface
1	Huvinahadagali	V_1S_1	2.62	1.36	12.96	11.02
2		V_1S_2	3.10	2.32	18.26	16.40
3		V_1S_3	2.84	0.76	16.26	14.42
4		V_1S_4	1.90	0.88	11.56	9.14
5		V_1S_5	3.76	2.72	22.52	20.86
6	Hanakanahalli	V_2S_1	2.36	0.32	17.18	16.46
7		V_2S_2	2.76	0.16	19.82	18.92
8		V_2S_3	1.92	0.34	10.20	8.98
9		V_2S_4	2.24	0.36	12.26	11.08
10		V_2S_5	1.46	0.18	9.82	8.54
11	Vinobhanagara	V_3S_1	0.62	0.31	2.96	2.62
12		V_3S_2	0.80	0.38	13.32	12.26
13		V_3S_3	0.30	0.17	12.58	11.78
14		V_3S_4	1.10	1.08	17.58	14.18
15		V_3S_5	1.78	1.64	19.38	16.32
16	Meerakornahalli	V_4S_1	0.44	0.30	3.10	2.60
17		V_4S_2	0.42	0.34	2.90	2.16
18		V_4S_3	1.34	0.96	6.96	5.06

19		V_4S_4	2.64	1.84	9.54	8.12
20		V_4S_5	2.04	1.36	7.14	6.34
21	Devagondanahalli	V_5S_1	1.36	1.57	3.00	2.18
22		V_5S_2	2.36	1.32	4.66	2.78
23		V_5S_3	2.42	1.24	5.04	4.66
24		V_5S_4	2.24	1.32	4.62	3.90
25		V_5S_5	2.56	1.46	5.12	3.36
26	Thippapura	V_6S_1	1.36	0.52	4.62	3.76
27		V_6S_2	0.90	0.36	3.00	2.42
28		V_6S_3	1.22	0.68	3.62	3.06
29		V_6S_4	0.42	0.28	2.44	2.12
30		V_6S_5	0.62	0.34	3.22	1.84
Lowest			**0.30**	**0.16**	**2.44**	**1.84**
Highest			**3.76**	**2.72**	**22.52**	**20.86**
Mean			**1.73**	**0.89**	**9.51**	**8.24**

4. Conclusion

It was concluded that in Jasmine growing area of HuvinaHadagalitaluk was depending on the nutrient nature, their concentration was either found in the range of deficit, or sufficient or in excessdue to poornutrient management practices result in low organic carbon content, poor soil fertility leading to low yield and low quality of Jasmine. On the basis of soil test report, the micronutrients are applied in proper quantity. Hence it is suggested to apply organic manures with biofertilizers along withjudicious use of chemical fertilizers.

5. References

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