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**Sharanabasava**
Ph.D. Scholar, Department of Soil Science, University of Agricultural Sciences, Raichur, Karnataka, India

**Manjunatha Bhanuvally**
Assistant Professor, Department of Soil Science, University of Agricultural Sciences, Raichur, Karnataka, India

**Vijaya B Wali**
Associate Professor, Department of Statistics, Department of Agricultural Economics, University of Agricultural Sciences, Raichur, Karnataka, India

**Mahadevswamy**
Professor and Head, Department of Agricultural Microbiology, University of Agricultural Sciences, Raichur, Karnataka, India

**S Ravi**
Scientist, Department of Soil Science, ICAR-KVK, Hagari, Karnataka, India

**Corresponding Author:**
**Sharanabasava**
Ph.D. Scholar, Department of Soil Science, University of Agricultural Sciences, Raichur, Karnataka, India

# Nutrient composition analysis of jasmine leaves in Huvina Hadagali Taluk: A study on macronutrients and micronutrients

**Sharanabasava, Manjunatha Bhanuvally, Vijaya B Wali, Mahadevswamy and S Ravi**

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## Abstract
Jasmine (*Jasminum azoricum*) is a commercially significant crop, valued for its fragrant flowers and essential oils. This study investigates the macronutrient and micronutrient composition of jasmine leaves in selected regions of Huvina Hadagali Taluk to assess nutrient variability and its potential impact on plant growth and productivity. Leaf samples from multiple villages were analyzed for key macronutrients (N, P, K, S) and micronutrients (B, Fe, Zn, Cu, Mn). The results revealed substantial variations in nutrient concentrations across different locations, indicating site-specific differences in soil fertility and nutrient availability. The observed variations emphasize the need for targeted nutrient management practices to optimize jasmine plant health and yield. Regular soil and leaf nutrient analysis can aid in developing effective fertilization strategies to maintain nutrient balance. Furthermore, adopting sustainable agricultural practices, including organic matter enrichment, balanced fertilization, and proper irrigation management, can mitigate nutrient deficiencies and imbalances. These findings highlight the importance of precise nutrient management for sustainable jasmine cultivation in the region.

**Keywords:** Jasmine, macronutrients, micronutrients, nutrient management, soil fertility, sustainable agriculture

## Introduction
Jasmine (*Jasminum azoricum*) is a commercially significant crop valued for its fragrant flowers and essential oils, which are widely used in perfumery, cosmetics, and pharmaceuticals. While flower yield and quality remain primary concerns in jasmine cultivation, plant health and productivity largely depend on adequate nutrient availability. Leaves serve as key indicators of plant nutrient status, and analyzing their composition can provide valuable insights into soil fertility and overall plant nutrition. Understanding nutrient variations can help optimize fertilization strategies and improve jasmine growth and yield.

Huvina Hadagali Taluk, a region known for jasmine cultivation, exhibits diverse soil conditions that may influence nutrient availability. This study aims to assess the macronutrient and micronutrient composition of jasmine leaves across different villages within the taluk. The macronutrients analyzed include nitrogen (N), phosphorus (P), potassium (K), and sulfur (S), which are essential for plant growth, metabolic functions, and structural development. Additionally, key micronutrients such as boron (B), iron (Fe), zinc (Zn), copper (Cu), and manganese (Mn) are evaluated to understand their role in maintaining plant health and productivity.

Variations in nutrient concentrations across different locations can provide crucial information regarding soil fertility disparities and potential deficiencies affecting jasmine cultivation. The findings from this study will support the development of targeted nutrient management practices, ensuring balanced fertilization and efficient resource utilization. Regular soil and leaf nutrient analysis can aid farmers in adopting sustainable agricultural practices such as organic matter enrichment, precise fertilization, and proper irrigation management. By addressing nutrient imbalances, this research contributes to the long-term sustainability of jasmine cultivation in Huvina Hadagali Taluk, ultimately enhancing crop yield and economic returns for farmers.

## Materials and Methods

The study was conducted in six villages of Huvina Hadagali taluk *viz*., Huvinahadagali, Hanakanahalli, Meerakornahalli, Vinobhanagara, Devagondanahalli and Thippapura of Vijayanagara district, Karnataka. Huvina Hadagali taluk was selected for the study as this taluk has the highest area of Jasmine cultivation in Karnataka. From each village five farmers were selected randomly and each farmer had more than five years of experiences in Jasmine cultivation. Huvinahadagali taluk comes under Northern Dry agro-climatic zone-III of Karnataka state. Soils are sandy loam in texture mixed with black and grey colour. Red soils are predominant. Study area is located at 14° 43" N latitude, 75° 39" E longitude with an altitude of 527 m above mean sea level. It is characterized by the lowest rainfall in Karnataka state with an average annual rainfall of 620 mm and with mean annual temperature of 33-37 °C.

### Preparation and storing of the plant samples

The collected plant samples were transferred to paper bags indicating the sample number and plant samples are dried at 65 to 70 °C ± 2 in new paper bags in a well ventilated hot air oven for 24 to 36 hours. The oven dried samples are ground in a grinder after transferred to air tight plastic bottles with a screw cap.

### Digestion of plant sample with a di-acid mixture

A 0.5 gram of powdered plant sample was pre-digested by adding 10 mL of concentrated $HNO_3$ and keeping overnight. The sample will be digested with 10 mL of the di-acid mixture ($HNO_3$: Perchloric acid in 10: 4 ratio) until a white residue was obtained. The volume of the digest was made up to 100 mL distilled water and used it for total elemental analysis.

### Chemical properties of Plant samples

### Total Nitrogen (%)

A 0.5 g of Plant sample were digested with concentrated sulphuric acid and digestion mixture ($K_2SO_4$: $CuSO_4$, $5H_2O$: Selenium in 100: 20: 1 ratio) till a green residue was obtained. The digested material was distilled in an alkaline medium to liberate ammonia, the liberated ammonia was estimated by titrating against std. $H_2SO_4$ (Piper, 1966) [2].

### Total Phosphorus (%)

A known volume of the di-acid digest was taken for total phosphorus determination using vandomolybdate phosphoric yellow colour method in the nitric acid system as described by Piper (1966) [2].

### Total Potassium (%)

The total potassium content in the plant sample was determined by the flame photometric method after diluting the known volume of the di-acid digest and determined using a flame photometer as outlined by Piper (1966) [2].

### Total Sulphur (%)

Sulphur present in a di-acid digest of the plant materials was determined by precipitating the sulphate with barium chloride and turbidity was measured at 420 nm using spectrophotometer as described by Piper (1966) [2].

### Total Boron (ppm)

Boron in plants was estimated through azomethane-H method and the colour developed was measured using spectrophotometer at 485 nm.

### Micronutrients Zn, Fe, Cu, and Mn (ppm)

In an aliquot of digested plant extract Fe, Mn, Zn, and Cu content was determined by using Atomic Absorption Spectrophotometer (PerkinElmer, make Analyst 400) fitted with appropriate hollow cathode lamps under specific measuring concentration as specified by Piper (1966) [2].

## Results and Discussion

The macronutrient concentration of jasmine leaves from different villages in Huvina Hadagali Taluk was analyzed, and the results are presented in Table 1. The study assessed the levels of nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) in leaf samples collected from six different villages. Premkumari and Balasubramanian, 1993 [3].

**Table 1:** Macronutrient concentration in Jasmine leaf of selected regions of Huvina Hadagali Taluk

| Sl. No | Village | Sample Code | N (%) | P (%) | K (%) | S (%) |
|---|---|---|---|---|---|---|
| 1 | Huvinahadagali | $V_1S_1$ | 1.32 | 0.32 | 1.33 | 0.16 |
| 2 | | $V_1S_2$ | 1.47 | 0.38 | 0.87 | 0.15 |
| 3 | | $V_1S_3$ | 1.59 | 0.41 | 1.15 | 0.18 |
| 4 | | $V_1S_4$ | 1.69 | 0.43 | 0.77 | 0.17 |
| 5 | | $V_1S_5$ | 1.87 | 0.48 | 1.03 | 0.15 |
| 6 | Hanakanahalli | $V_2S_1$ | 1.73 | 0.45 | 1.10 | 0.19 |
| 7 | | $V_2S_2$ | 1.52 | 0.35 | 0.60 | 0.14 |
| 8 | | $V_2S_3$ | 1.38 | 0.30 | 1.00 | 0.18 |
| 9 | | $V_2S_4$ | 1.6 | 0.34 | 1.70 | 0.17 |
| 10 | | $V_2S_5$ | 1.57 | 0.36 | 0.94 | 0.18 |
| 11 | Vinobhanagara | $V_3S_1$ | 1.47 | 0.35 | 1.08 | 0.20 |
| 12 | | $V_3S_2$ | 1.67 | 0.47 | 1.31 | 0.14 |
| 13 | | $V_3S_3$ | 1.55 | 0.42 | 0.55 | 0.22 |
| 14 | | $V_3S_4$ | 1.44 | 0.37 | 1.42 | 0.16 |
| 15 | | $V_3S_5$ | 1.66 | 0.45 | 1.21 | 0.19 |
| 16 | Meerakornahalli | $V_4S_1$ | 1.59 | 0.38 | 1.09 | 0.15 |
| 17 | | $V_4S_2$ | 1.46 | 0.34 | 1.37 | 0.18 |
| 18 | | $V_4S_3$ | 1.66 | 0.44 | 1.40 | 0.20 |
| 19 | | $V_4S_4$ | 1.45 | 0.33 | 0.94 | 0.12 |
| 20 | | $V_4S_5$ | 1.52 | 0.46 | 0.66 | 0.14 |
| 21 | Devagondanahalli | $V_5S_1$ | 1.46 | 0.38 | 0.92 | 0.16 |
| 22 | | $V_5S_2$ | 1.43 | 0.36 | 1.18 | 0.11 |
| 23 | | $V_5S_3$ | 1.58 | 0.42 | 1.58 | 0.19 |
| 24 | | $V_5S_4$ | 1.62 | 0.47 | 1.12 | 0.15 |
| 25 | | $V_5S_5$ | 1.56 | 0.41 | 1.03 | 0.18 |
| 26 | Thippapura | $V_6S_1$ | 1.64 | 0.46 | 0.89 | 0.17 |
| 27 | | $V_6S_2$ | 1.59 | 0.40 | 0.87 | 0.13 |
| 28 | | $V_6S_3$ | 1.48 | 0.38 | 1.00 | 0.21 |
| 29 | | $V_6S_4$ | 1.52 | 0.41 | 1.02 | 0.26 |
| 30 | | $V_6S_5$ | 1.65 | 0.43 | 0.42 | 0.11 |
| Lowest | | | 1.32 | 0.30 | 0.42 | 0.11 |
| Highest | | | 1.87 | 0.48 | 1.70 | 0.26 |
| Mean | | | 1.56 | 0.40 | 1.05 | 0.17 |

### Nitrogen (N) Concentration

The nitrogen content in jasmine leaves ranged from 1.32% (lowest) to 1.87% (highest), with a mean of 1.56%. The highest nitrogen concentration was recorded in sample V1S5 from Huvinahadagali village, whereas the lowest was observed in sample V1S1 from the same village. In general, nitrogen levels were fairly consistent across different villages, indicating uniform soil fertility and nutrient availability in the study area.

### Phosphorus (P) Concentration

The phosphorus content varied between 0.30% and 0.48%, with an average of 0.40%. The highest phosphorus concentration was found in sample V1S5 from Huvinahadagali, while the lowest was recorded in sample V2S3 from Hanakanahalli. Phosphorus is essential for plant energy transfer processes and root development, and the observed variations might be attributed to differences in soil phosphorus availability and fertilizer applications.

**Potassium (K) Concentration**

Potassium levels exhibited significant variation, ranging from 0.42% to 1.70%, with a mean of 1.05%. The highest potassium concentration was observed in sample V2S4 from Hanakanahalli, whereas the lowest was recorded in sample V6S5 from Thippapura. Potassium is a vital nutrient for plant growth, aiding in enzyme activation and water regulation. The variation in potassium content across samples suggests differences in soil potassium reserves and nutrient uptake efficiency.

**Sulfur (S) Concentration**

Sulfur concentration in jasmine leaves ranged between 0.11% and 0.26%, with an average of 0.17%. The highest sulfur content was recorded in sample V6S4 from Thippapura, while the lowest was found in sample V5S2 from Devagondanahalli. Sulfur plays a crucial role in amino acid synthesis and overall plant metabolism. The differences in sulfur levels could be due to variations in soil sulfur availability and atmospheric deposition.

**Table 2:** Micronutrient concentration in Jasmine leaf of selected regions of Huvina Hadagali Taluk

| Sl. No. | Village | Sample Code | B (ppm) | Fe (ppm) | Zn (ppm) | Cu (ppm) | Mn (ppm) |
|---|---|---|---|---|---|---|---|
| 1 | Huvinahadagali | $V_1S_1$ | **16** | 224 | 18 | 14 | 310 |
| 2 | | $V_1S_2$ | 18 | 290 | 20 | 24 | 340 |
| 3 | | $V_1S_3$ | 22 | 264 | 24 | 32 | 310 |
| 4 | | $V_1S_4$ | 23 | 254 | 14 | 22 | 314 |
| 5 | | $V_1S_5$ | 24 | 232 | 24 | 36 | 328 |
| 6 | Hanakanahalli | $V_2S_1$ | 23 | 222 | 18 | 22 | 320 |
| 7 | | $V_2S_2$ | 18 | 246 | 26 | 22 | 324 |
| 8 | | $V_2S_3$ | 21 | 276 | 20 | 26 | 302 |
| 9 | | $V_2S_4$ | 20 | 296 | 26 | 24 | 362 |
| 10 | | $V_2S_5$ | 17 | 188 | 36 | 22 | 276 |
| 11 | Vinobhanagara | $V_3S_1$ | 21 | 254 | 38 | 24 | 262 |
| 12 | | $V_3S_2$ | 22 | 216 | 34 | 14 | 200 |
| 13 | | $V_3S_3$ | 19 | 248 | 36 | 18 | 378 |
| 14 | | $V_3S_4$ | 20 | 290 | 20 | 16 | 294 |
| 15 | | $V_3S_5$ | 21 | 216 | 46 | 20 | 286 |
| 16 | Meerakornahalli | $V_4S_1$ | 16 | 254 | 16 | 22 | 360 |
| 17 | | $V_4S_2$ | 18 | 166 | 26 | 14 | 280 |
| 18 | | $V_4S_3$ | 20 | 290 | 50 | 44 | 378 |
| 19 | | $V_4S_4$ | 21 | 220 | 15 | 28 | 394 |
| 20 | | $V_4S_5$ | 20 | 282 | 12 | 24 | 282 |
| 21 | Devagondanahalli | $V_5S_1$ | 22 | 136 | 26 | 24 | 242 |
| 22 | | $V_5S_2$ | 20 | 266 | 28 | 60 | 260 |
| 23 | | $V_5S_3$ | 21 | 220 | 14 | 46 | 200 |
| 24 | | $V_5S_4$ | 22 | 260 | 34 | 32 | 392 |
| 25 | | $V_5S_5$ | 20 | 220 | 24 | 12 | 346 |
| 26 | Thippapura | $V_6S_1$ | 20 | 296 | 58 | 16 | 136 |
| 27 | | $V_6S_2$ | 22 | 240 | 68 | 16 | 330 |
| 28 | | $V_6S_3$ | 21 | 292 | 20 | 22 | 332 |
| 29 | | $V_6S_4$ | 21 | 216 | 26 | 22 | 394 |
| 30 | | $V_6S_5$ | 20 | 164 | 14 | 24 | 306 |
| Lowest | | | 16 | 136 | 12 | 12 | 136 |
| Highest | | | 24 | 296 | 68 | 60 | 394 |
| Mean | | | 20.3 | 241.27 | 27.70 | 24.73 | 307.93 |

The micronutrient concentration of jasmine leaves from different villages in Huvina Hadagali Taluk was analyzed, and the results are presented in Table 2. The study assessed the levels of boron, Iron, Zinc, Copper and Manganese in leaf samples collected from six different villages. Govindan and Purushothaman, 1984 [1].

**Boron (B) Concentration**

The boron content varied between 16 ppm and 24 ppm, with a mean of 20.3 ppm. The highest concentration was recorded in sample V1S5 from Huvinahadagali, while the lowest was in V1S1 from the same village. Boron is essential for cell wall formation and reproductive growth, and variations could be linked to soil boron availability and organic matter content.

**Iron (Fe) Concentration**

Iron concentration ranged from 136 ppm to 296 ppm, with an average of 241.27 ppm. The highest iron content was observed in sample V6S1 from Thippapura, whereas the lowest was in sample V5S1 from Devagondanahalli. Iron plays a crucial role in chlorophyll synthesis and enzyme activation. The variation might be due to differences in soil pH, organic matter, and iron oxide content.

**Zinc (Zn) Concentration**

Zinc levels ranged from 12 ppm to 68 ppm, with a mean of 27.7 ppm. The highest concentration was recorded in sample V6S2 from Thippapura, while the lowest was observed in sample V4S5 from Meerakornahalli. Zinc is important for enzyme activity and protein synthesis, and the variation could be attributed to differences in soil pH, moisture content, and fertilizer application.

**Copper (Cu) Concentration**

Copper content varied between 12 ppm and 60 ppm, with an average of 24.73 ppm. The highest copper concentration was recorded in sample V5S2 from Devagondanahalli, while the lowest was in sample V5S5 from the same village. Copper is essential for lignin synthesis and respiration. The variation might be due to differences in soil organic matter, microbial activity, and irrigation practices.

**Manganese (Mn) Concentration**

Manganese levels ranged from 136 ppm to 394 ppm, with a mean of 307.93 ppm. The highest concentration was observed in sample V4S4 from Meerakornahalli, whereas the lowest was recorded in sample V6S1 from Thippapura. Manganese is vital for photosynthesis and enzyme activation, and the observed differences could be due to soil redox conditions, pH levels, and organic matter interactions.

## Conclusion

The observed variations emphasize the need for site-specific nutrient management practices to optimize jasmine plant growth and productivity. Regular soil and leaf nutrient analysis can help in devising appropriate fertilization strategies to maintain balanced nutrient availability and enhance crop yield. Additionally, adopting sustainable agricultural practices, such as organic matter enrichment, balanced fertilization, and proper irrigation management, can help mitigate nutrient deficiencies and imbalances in the region.

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