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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 3489-3500

www.thepharmajournal.com
Received: 27-09-2022
Accepted: 29-10-2022

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Effect of split doses of fertilizers on nutrient quality of mulberry leaves under temperate climatic conditions

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Abstract
Investigations on response of different types of mulberry plantation including tall, dwarf and bush to application of varied fertilizer doses indicated significant influence on mulberry if applied in equal splits. In tall plantation N, P, Ca, Mg, Zn, Fe & Mn (3.280%, 0.272%, 1.042%, 0.368%, 45.123 ppm, 334.310 ppm & 54.211 ppm) was higher in T1 when fertilizer was applied in two equal splits viz 150:60:60 NPK while as K, S, Cu (1.933%, 0.359% & 13.982 ppm) was higher in T2 (175:85:85 NPK) during spring 2019. However in dwarf mulberry plantation N, P, S & Mn was higher in treatment T2 (3.231%, 0.219%, 1.703% & 53.765 ppm) while as K, Ca, Mg, Zn & Fe was higher in T1 (1.703%, 1.041%, 0.347%, 44.113 ppm & 324.312 ppm). During autumn 2019 in tall mulberry plantation N, P, K, Mg, Zn, Fe & Mn (3.277%, 0.174%, 1.361%, 0.673%, 12.08 ppm, 177.76 ppm & 77.37 ppm) was higher in T1. However N, P, K, Mg, S, Fe & Mn was higher in T1 (3.127%, 0.200%, 1.377%, 0.720%, 0.180%, 247.01 ppm & 83.70 ppm) along with zinc in T2 (9.65 ppm) in dwarf plantation during autumn 2019. Equal split application of recommended dose of fertilizers (NPK) exhibited improvement in quality of mulberry leaf for overall sustenance of sericulture.

Keywords: Mulberry, split fertilizer, macro nutrients, micronutrients

1. Introduction
Silkworm (*Bombyx mori* L.) is monophagous insect deriving its nutrients from mulberry leaf belonging to genus *Morus* of family *Moraceae*. Mulberry leaf is the only food of silkworm *Bombyx mori* L. and the quality of mulberry leaf has a profound influence upon silkworm rearing and thus the cocoon crop. Leaf quality in turn is dependent upon variety, biotic and abiotic agents, timely conduct of various intercultural operations and of course timely fertilizer application in its recommended doses as per package of practice. Mulberry plants are trained in many ways giving due cognizance to leaf harvest and disease control. The three training types of mulberry include bush, dwarf and tall. In all the three types recommended dose of fertilizer application viz., NPK (300:120:120)/ha/yr. is resorted to. Although fertilizer application in mulberry is conducted as per recommended package of practices formulated earlier, yet with the changing agricultural scenario and various health concerns coupled with cost escalation in various inputs a need has been felt to revisit the fertilizer schedule and dosage of fertilizer application. Since mulberry is the only food for silkworms, efforts are on to improve the quality of mulberry leaf through various inputs and strategy is being developed to increase the production of quality mulberry leaf under reduced input application. Split application of fertilizer doses has also been found to be more effective and beneficial for the plant growth and finally the productivity due to high assimilation rate by the plants (Giri *et al.*, 2016) [4]. The studies of Nooruldin *et al.* (2015) [10] revealed that split application of P and K along with N exhibited quality improvement in mulberry leaf suggesting the need for rescheduling the existing fertilizer schedule under Kashmir climatic conditions, that too under different mulberry plantation types.

2. Materials and Methods
Experiment was conducted at College of Temperate Sericulture, Mirgund, Sher-e-Kashmir University of Agricultural Sciences and Technology; Kashmir during 2019 in the months of April-September. Goshoerami variety of mulberry which is in fact the introduction from Japan with tall, dwarf and bush type was used for the study as it continues to be most popular variety of mulberry with the rearers. The tall plantation was maintained at a spacing of 8´x 9´ (1500 plants per hectare), whereas dwarf and bush plants were maintained at a spacing of 6´x 4´ and

1.5´x 3´ with 4500 plants per hectare and 24000 plants per hectare respectively. Cultural operations including pruning, weeding and irrigation etc. were followed as per the package of practices recommended by the College of Temperate Sericulture, Mirgund except for the application of chemical fertilizer which was done as per technical program/ treatments. NPK was supplied to soil through Urea (containing 46 per cent N); DAP (containing 46 per cent $P_2 0_5$ and 18 per cent of N) and MOP (containing 60 percent K_2O). The fertilizer was applied in two splits, first in the 1st week of April and the second in first fortnight of July after pruning. Pruning of the mulberry plants was done only once in a year, in the first week of June, corresponding with the end of spring rearing by resorting to basal pruning. All the three fertilizers were mixed as per the treatment combinations and applied near the root zone. Randomized Block Design was followed for the experiment. There were 5 treatments of NPK fertilizers viz., T1 (300:120:120) applied in 2 equal splits (150:60:60), T2 (350:170:170) applied in 2 equal splits (175:85:85), T3 (250:70:70) applied in 2 equal splits (125:35:35), T4 (300:120:120) 1st split was applied as 150:120:120 2nd split as 150:0:0 and in T5 (0:0:0) no fertilizer was applied. The number of replication/treatment was 4 and in each replication 6 plants were selected. For chemo assay three kinds of representative samples i.e. tender, medium, and coarse, meant for various instars of silkworm rearing (chawki and late age) were collected from plants under the study. The fresh leaf samples were packed in paper bags then were shade dried for few days and dried in oven at 60^{o}c for one hour. The samples were separately homogenized in a stainless-steel blender to pass through 2mm mesh sieve and were stored in airtight sealed polythene bags. Nitrogen was estimated by following Kjeldahl, S method, phosphorous (Vandomolybedate phosphoric acid yellow color method), potassium (flame photometer), calcium and magnesium (Versenate-titration method) given by Jackson (1973) [7]. Sulfur was determined by turbidimetric method given by Chesnin and Yien (1951) [3]. Micronutrient cations (Zn, Cu, Mn and Fe) were determined on AAS (Atomic absorption spectrophotometer) as described by Lindsay and Norvell (1978). [8] The data collected was compiled and analyzed statistically using a method described by Gomez and Gomez (1984) [5]. The significance was tested at 5 percent level of significance.

3. Results

Perusal of data pertaining to nitrogen as influenced by the varied fertilizer doses in tall mulberry plantation (Goshoerami) during spring 2019 showed significant variations and revealed that highest nitrogen content of leaf Viz., 3.280 percent was recorded in T1 and lowest N content of 2.032% was observed in T5 (Table-1 and Fig-1). However, during autumn 2019 significantly higher N content was observed in T4 (3.390%) and minimum in T5 (2.825%) (Table-2 and Fig-4)while as, Dwarf mulberry plantation also showed significant variations in leaf nitrogen content during spring 2019 with highest N content observed in T2 (3.231%) and lowest nitrogen content in T3 (2.121%) (Table-1 and Fig-1). However, during autumn 2019 significantly higher nitrogen content was observed in T1 (3.127%) and minimum in T5 (2.678%) (Table-2 and Fig-4). Leaf nitrogen content in bush mulberry with regard to both the seasons revealed non-significant differences (Table-1 and Fig-1) & (Table-2 and Fig-4).

Leaf phosphorous content in tall mulberry plantation during spring showed significant variations with 0.272% in T1 and lowest P content of 0.201% was recorded in T5 (Table-1 and Fig-2). During autumn 2019 highest P content was recorded in T1 (0.174%) least P content was recorded in T5 (0.140%) (Table-2 and Fig-5) Data pertaining to phosphorous as influenced by varied fertilizer doses during spring 2019 revealed significant variation in dwarf mulberry plantation highest P content of 0.219% was recorded in T2 and lowest phosphorous content was observed in T5 (0.211%) respectively (Table-1 and Fig-2). However, during autumn 2019 significantly higher phosphorous content in dwarf mulberry plantation was recorded in T1 (0.200%) and minimum P content was recorded in T5 (0.119%) (Table-2 and Fig-5) while as Phosphorous as influenced by varied fertilizer doses in bush mulberry plantation (Goshoerami) during spring 2019 and autumn 2019 showed non-significant variations. (Table-1 and Fig-2) (Table-2 and Fig-5)

Potassium content of leaf in tall mulberry plantation during spring showed significant variations with a value of 1.933% in T2 and lowest K content of 1.541% was recorded in T5 (Table-1 and Fig-3). However, during autumn 2019 significantly higher K content was recorded in T3 (1.323%) and least leaf potassium content was observed in T2 (1.211%) (Table-2 and Fig-6) During spring 2019 in dwarf mulberry plantation highest K content of 1.703% was recorded in T1 and lowest potassium content was observed in T5 (1.221%) respectively (Table-1 and Fig-3). While as during autumn 2019 significantly higher potassium content was recorded in T1 (1.377%) & T3 (1.377%) and least potassium content was observed in T5 (1.261%) (Table-2 and Fig-6). Leaf potassium content during spring and autumn 2019 showed non-significant differences among the treatments in bush mulberry plantation. (Table-1 and Fig-3) (Table-2 and Fig-6).

Leaf calcium content in tall mulberry plantation during spring 2019 showed significant variations with highest Ca content of 1.042% in T1 and lowest K content of 0.796% was recorded in T5 (Table-3 and Fig-7). Data pertaining to leaf calcium during spring 2019 revealed significant variation in dwarf mulberry plantation. Highest Ca content of 1.041% was recorded in T1 and lowest calcium content was observed in T5 (0.746%) respectively (Table-3 and Fig-7) while as calcium content of leaf in bush mulberry plantation during spring 2019 showed significantly highest Ca content of 1.041% in T1 and lowest calcium content of 0.554% was recorded in T4 respectively (Table-3 and Fig-7). During autumn 2019 calcium showed non-significant differences in tall, dwarf and bush mulberry plantation (Table-4 and Fig10)

Leaf magnesium content in tall mulberry plantation during spring 2019 showed significant variations with highest Mg content of 0.386% in T1 and least magnesium content was recorded in T4 (0.214%) (Table-3 and Fig-8) However, during autumn 2019 significantly higher magnesium content was recorded in T1 (0.673%) and least Mg content was recorded in T4 (0.569%) (Table-4 and Fig-11) Data pertaining to magnesium as influenced by varied fertilizer doses during spring 2019 revealed significant variation in dwarf mulberry plantation. Highest Mg content of 0.347% was recorded in T1 and lowest magnesium content was observed in T5 (0.282%) respectively (Table-3 and Fig-8). While as, during autumn 2019 T1 recorded maximum magnesium content of 0.720% and least Mg content was recorded in T5 (0.488%) (Table-4 and Fig-11). During spring 2019 magnesium showed non-significant differences in bush mulberry plantation (Table-3 and Fig-8) While as during autumn data pertaining to magnesium as influenced by varied fertilizer doses showed significant variation in bush mulberry plantation significantly highest Mg content was recorded in T1(0.658%) and least Mg content was recorded in T5 (0.455%) (Table-4 and Fig-11).

Data pertaining to leaf sulfur content of tall mulberry plantation indicated significant differences. Significantly maximum sulfur content of 0.359% was recorded in T2 and minimum sulfur content was recorded in T5 (0.279%) (Table-3 and Fig-9) However, during autumn sulfur showed non-significant differences in tall mulberry plantation (Table-4 and Fig-12). Dwarf mulberry plantation during spring 2019 indicated significant differences, maximum sulfur content of 0.348% was recorded in T2 and minimum sulfur content was recorded in T5 (0.239%) (Table-3 and Fig-9) While as, during autumn 2019 significantly higher sulfur (%) was observed in T1 (0.180%) while as T5 (0.139%) recorded minimum sulfur content. (Table-4 and Fig-12). Leaf sulfur content of bush mulberry plantation indicated significant differences. Significantly maximum sulfur content of 0.349% was recorded in T2 minimum sulfur content was recorded in T5 (0.249%) (Table-3 and Fig-9) However, during autumn 2019 maximum sulfur content was recorded in T2 (0.126%) followed and minimum S was recorded in T5 (0.070%) (Table-4 and Fig-12).

Significantly maximum zinc content of 45.123 ppm was recorded in T1 in tall mulberry plantation during spring 2019 and minimum zinc content of 30.123 ppm was observed in T5 (Table-5 and Fig-13). However, during autumn T1 recorded maximum zinc content of 12.08 ppm which was at par with T2 (11.04 ppm). Minimum zinc content of 8.97 ppm was recorded in T5 (Table-6 and Fig-17). Data pertaining to zinc content of dwarf mulberry plantation (Goshoerami) during spring season also indicated significant variations. Significantly maximum zinc content of 44.113 ppm was recorded in T1 minimum zinc content of 29.121 ppm was observed in T5 (Table-5 and Fig-13). While as, during autumn 2019 maximum zinc content was recorded in T2 (9.65 ppm) and minimum was recorded in T5 (7.94 ppm) (Table-6 and Fig-17). Influence of varied fertilizer doses on bush mulberry plantation during spring showed significant variations. Significantly maximum Zn content of 45.143 ppm was observed in T1 and minimum zinc content of 30.113 ppm was observed in T5 (Table-5 and Fig-13). While as, during autumn 2019 non-significant differences were observed with regard to the content of zinc in bush mulberry plantation (Table-6 and Fig-17).

Data pertaining to copper content of tall mulberry plantation (Goshoerami) during spring season revealed significant variations. Significantly maximum copper content of 13.982 ppm was recorded in T2 which was at par with T1 (13.104 ppm and minimum copper content of 10.432 ppm was observed in T5 (Table-5 and Fig-14). However, during autumn 2019 non-significant differences were observed (Table-6 and Fig-18) Dwarf mulberry plantation (Goshoerami) during spring as well as autumn season of 2019 showed non-significant variations (Table-5&6) (Fig-14& Fig-18)Influence of varied fertilizer doses on bush mulberry plantation during spring showed non-significant variations (Table-5 and Fig-14), while as during autumn 2019 significant differences were observed significantly higher copper content was recorded in T1 (9.05 ppm) and least copper content was recorded in T3(8.17 ppm) (Table-6 and Fig-18).

Data pertaining to iron content of tall mulberry plantation during spring season recorded significant variations. Significantly maximum iron content of 334.310 ppm was recorded in T1 minimum Fe content of 232.021 ppm was observed in T5 (Table-5and Fig-15). However, during autumn 2019 significantly higher iron content of 177.76 ppm was recorded in and minimum iron content was recorded in T5(139.22 ppm) (Table-6 and Fig-19). Dwarf mulberry plantation (Goshoerami) during spring season of showed significant variations. Significantly maximum iron content of 324.312 ppm was recorded in T1 and minimum Fe content of 222.981 ppm was observed in T5 (Table-5 and Fig-15), whereas during autumn 2019, T1 recorded maximum Fe content of 247.01 ppm while as minimum Fe content was recorded in T5 (151.00 ppm) (Table-6 and Fig-19) Bush mulberry plantation during spring 2019 also showed significant variations. Maximum Fe content of 333.300 ppm was observed in T1, followed by T2 (321.961 ppm) and T4 (253.912 ppm) and minimum Fe content of 232.021 ppm was observed in T5 (Table-5 and Fig-15). However, during autumn 2019 non-significant differences were observed in Fe content of bush mulberry plantation (Table-6 and Fig-19)

Tall mulberry plantation during spring 2019 showed significant variations. Significantly maximum manganese content of 54.221 ppm was observed in T1 and minimum manganese content was observed in T5 (39.121 ppm) (Table-5 and Fig-16). While as, during autumn 2019 significantly higher manganese content was recorded in T1 (77.37 ppm) and least manganese content of 52.66 ppm was however recorded in T5 (Table-6 and Fig-20) Dwarf mulberry plantation during spring season also showed significant variations (Table-5 and Fig-16). Significantly maximum manganese content of 53.765 ppm was recorded in T2 minimum manganese content of 38.101 ppm was observed in T5. However, during autumn 2019 maximum content of manganese was recorded in T1 (83.70 ppm) and minimum manganese content was observed in T5 (63.22 ppm) (Table-6 and Fig-20). Bush mulberry plantation during spring season showed non-significant difference among the treatments. However, data pertaining to manganese content of bush mulberry plantation during autumn season of 2019 as influenced by varied fertilizer doses showed significant variations. T1 was significantly higher with manganese content of 92.74 ppm which was statistically at par with T2 (88.13 ppm). Least manganese content was recorded in T5 (66.83 ppm). (Table-6 and Fig-20).

Table 1: Macronutrient content in leaf as influenced by varied fertilizer doses during spring 2019

Treatments	Nitrogen (%)			Phosphorous (%)			Potassium (%)		
	Tall	Dwarf	Bush	Tall	Dwarf	Bush	Tall	Dwarf	Bush
T1	3.280^{a}	3.168^{a}	3.000	0.272^{a}	0.216^{a}	0.271	1.906^{a}	1.703^{a}	1.988
T2	3.128^{a}	3.231^{a}	3.111	0.268^{a}	0.219^{a}	0.267	1.933^{a}	1.651^{a}	1.956
T3	2.820^{b}	2.121^{c}	2.981	0.210^{c}	0.209^{b}	0.251	1.652^{c}	1.502^{b}	1.528
T4	2.762^{b}	2.345^{b}	2.987	0.221^{b}	0.203^{c}	0.242	1.698^{b}	1.558^{b}	1.598
T5	2.032^{c}	2.198^{c}	2.981	0.201^{d}	0.211^{b}	0.237	1.541^{d}	1.221^{c}	1.441
C.D ($p \leq 0.05$)	0.410	0.079	NS	0.004	0.006	NS	0.029	0.058	NS

Table 2: Macronutrient content in leaf as influenced by varied fertilizer doses during autumn 2019

Treatments	Nitrogen (%)			Phosphorous (%)			Potassium (%)		
	Tall	Dwarf	Bush	Tall	Dwarf	Bush	Tall	Dwarf	Bush
T1	3.277^{a}	3.127^{a}	2.914	0.174^{a}	0.200^{a}	0.189	1.361^{a}	1.377^{a}	1.443
T2	3.173^{a}	3.061^{a}	2.888	0.169^{a}	0.158^{a}	0.144	1.211^{c}	1.332^{a}	1.514
T3	2.939^{b}	3.041^{b}	2.762	0.163^{b}	0.155^{a}	0.176	1.323^{a}	1.377^{a}	1.566
T4	3.390^{a}	2.901^{c}	2.924	0.143^{c}	0.146^{b}	0.154	1.280^{b}	1.327^{b}	1.463
T5	2.825^{c}	2.678^{c}	2.558	0.140^{c}	0.119^{b}	0.121	1.267^{b}	1.261^{c}	1.360
C.D ($p \leq 0.05$)	0.109	0.072	NS	0.009	0.046	NS	0.042	0.049	NS

Table 3: Secondary nutrient content in leaf as influenced by varied fertilizer doses during spring 2019

Treatments	Calcium (%)			Magnesium (%)			Sulfur (%)		
	Tall	Dwarf	Bush	Tall	Dwarf	Bush	Tall	Dwarf	Bush
T1	1.042^{a}	1.041^{a}	1.041^{a}	0.386^{a}	0.347^{a}	0.337	0.336^{a}	0.334^{a}	0.334^{b}
T2	1.026^{a}	1.032^{a}	1.036^{a}	0.371^{a}	0.345^{a}	0.344	0.359^{a}	0.348^{a}	0.349^{a}
T3	0.982^{b}	0.972^{a}	0.782^{b}	0.293^{b}	0.302^{b}	0.322	0.315^{b}	0.305^{b}	0.335^{b}
T4	0.954^{c}	0.934^{b}	0.554^{d}	0.214^{d}	0.297^{c}	0.319	0.309^{b}	0.301^{b}	0.349^{a}
T5	0.796^{d}	0.746^{c}	0.696^{c}	0.251^{c}	0.282^{d}	0.298	0.279^{c}	0.239^{c}	0.249^{c}
C.D ($p \leq 0.05$)	0.018	0.081	0.006	0.018	0.004	NS	0.029	0.017	0.005

Table 4: Secondary nutrient content in leaf as influenced by varied fertilizer doses during autumn 2019

Treatments	Calcium (%)			Magnesium (%)			Sulfur (%)		
	Tall	Dwarf	Bush	Tall	Dwarf	Bush	Tall	Dwarf	Bush
T1	1.435	1.593	1.627	0.673^{a}	0.720^{a}	0.658^{a}	0.206	0.180^{a}	0.112^{b}
T2	1.375	1.512	1.635	0.671^{a}	0.687^{a}	0.626^{a}	0.204	0.168^{a}	0.126^{a}
T3	1.417	1.546	1.496	0.578^{b}	0.520^{c}	0.554^{b}	0.198	0.162^{a}	0.100^{b}
T4	1.411	1.546	1.575	0.569^{c}	0.581^{b}	0.512^{c}	0.191	0.140^{b}	0.098^{c}
T5	1.312	1.506	1.613	0.577^{b}	0.488^{a}	0.455^{d}	0.189	0.139^{b}	0.070^{d}
C.D ($p \leq 0.05$)	NS	NS	NS	0.004	0.039	0.039	NS	0.019	0.012

Table 5: Micronutrient content in leaf as influenced by varied fertilizer doses during spring 2019

Treatments	Zinc (ppm)			Copper (ppm)			Iron (ppm)			Manganese (ppm)		
	Tall	Dwarf	Bush	Tall	Dwarf	Bush	Tall	Dwarf	Bush	Tall	Dwarf	Bush
T1	45.123^{a}	44.113^{a}	45.143^{a}	13.104^{a}	12.110	13.124	334.310^{a}	324.312^{a}	333.300^{a}	54.211^{a}	53.201^{a}	54.201
T2	42.193^{a}	41.103^{a}	42.123^{a}	13.982^{a}	12.002	13.921	323.981^{a}	323.881^{a}	321.961^{b}	53.987^{a}	53.765^{a}	53.927
T3	36.220^{b}	35.221^{b}	36.231^{b}	12.165^{b}	12.135	12.145	256.132^{b}	255.102^{b}	252.152^{c}	51.023^{b}	51.013^{a}	51.023
T4	34.211^{b}	33.201^{b}	34.201^{b}	12.078^{b}	12.010	12.058	251.981^{b}	251.581^{b}	253.912^{c}	50.982^{b}	50.680^{a}	50.962
T5	30.123^{c}	29.121^{c}	30.113^{c}	10.432^{c}	10.132	10.412	232.021^{c}	222.981^{c}	232.021^{d}	39.121^{c}	38.101^{b}	49.131
C.D ($p \leq 0.05$)	3.032	3.031	3.652	0.928	NS	NS	20.023	10.432	9.342	0.298	8.320	NS

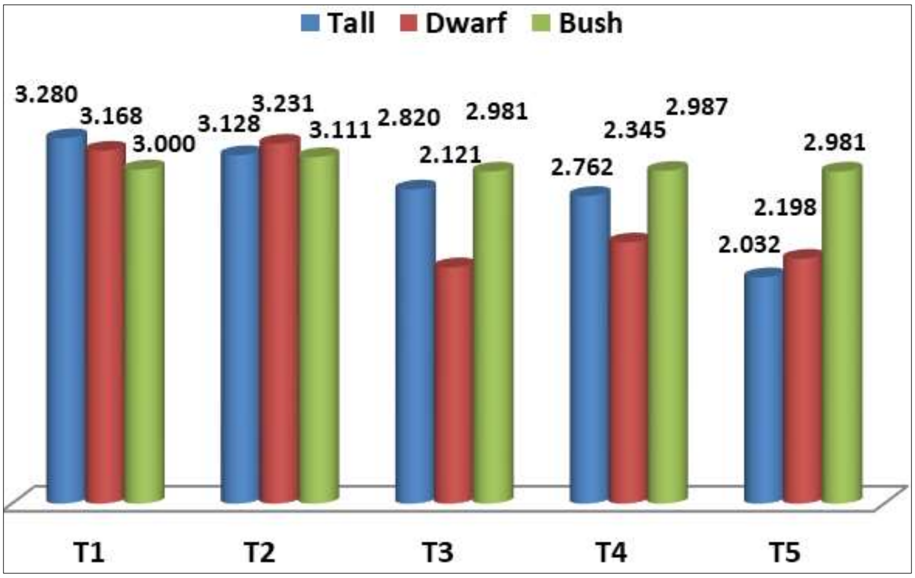

Fig 1: Graphical representation of nitrogen content in leaf during spring 2019

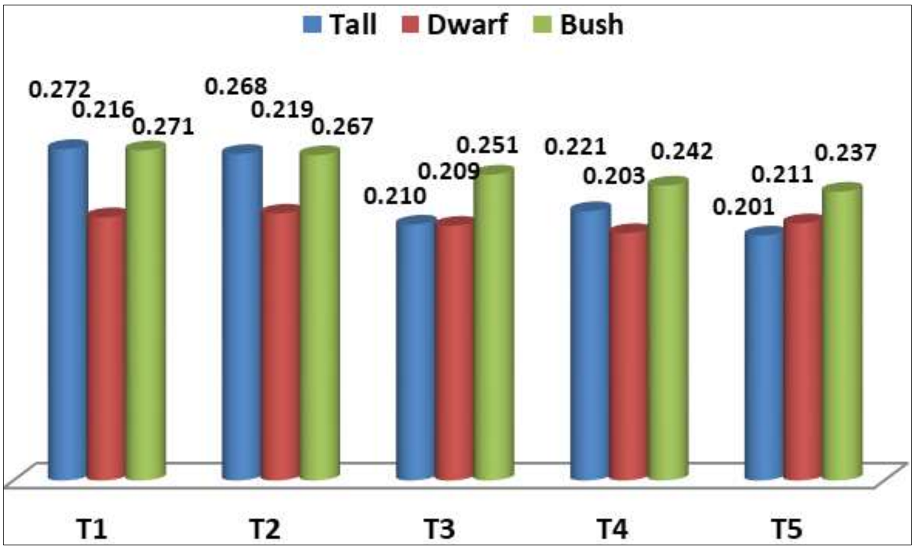

Fig 2: Graphical representation of phosphorous content in leaf during spring 2019

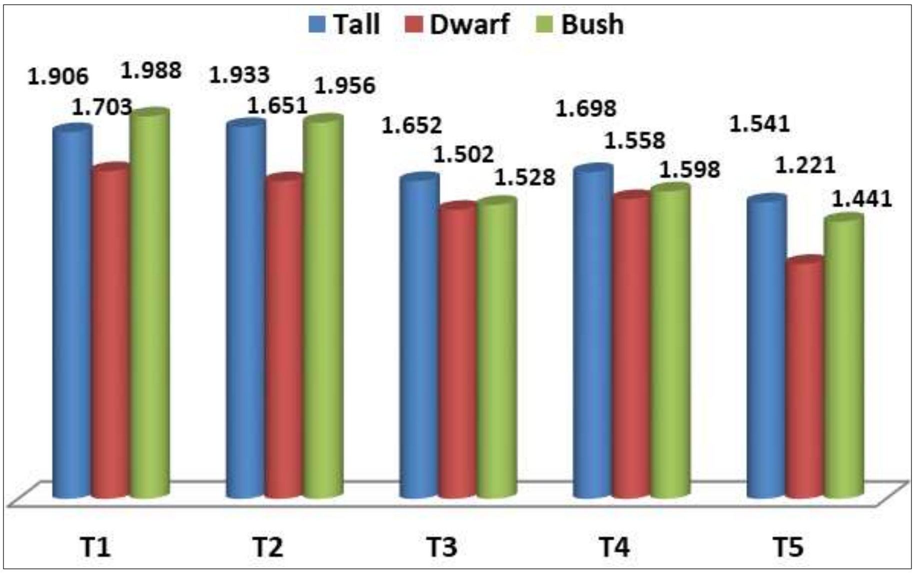

Fig 3: Graphical representation of potassium content in leaf during spring 2019

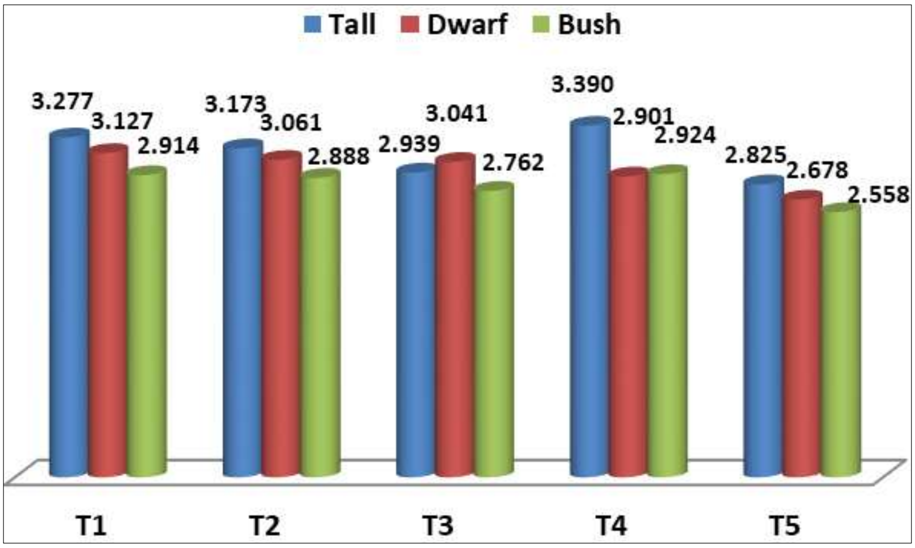

Fig 4: Graphical representation of nitrogen content in leaf during autumn 2019

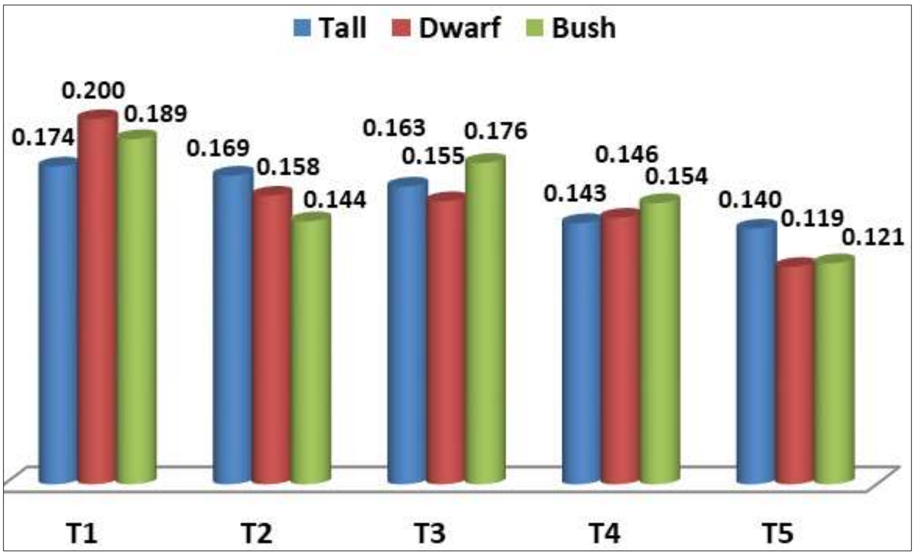

Fig 5: Graphical representation of phosphorous content in leaf during autumn 2019

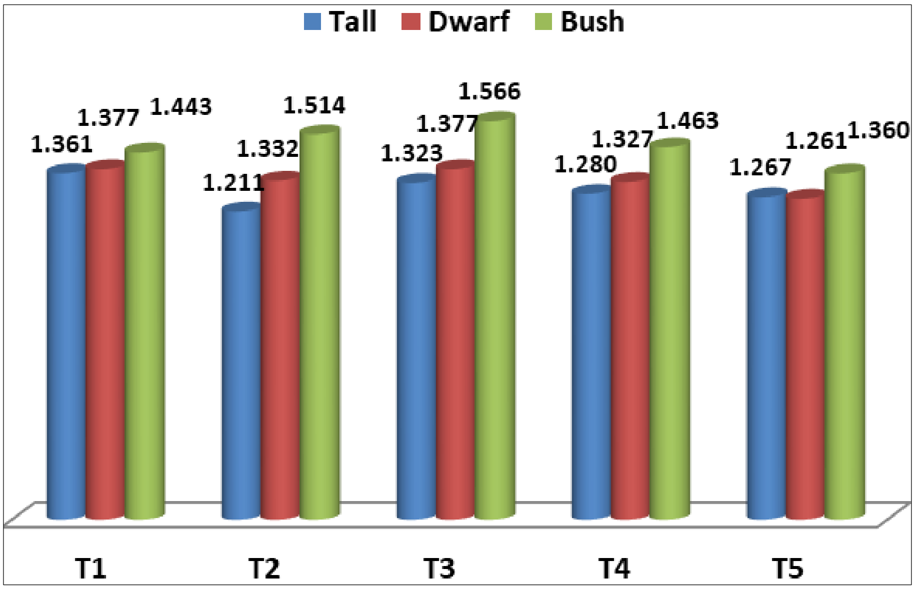

Fig 6: Graphical representation of potassium content in leaf during autumn 2019

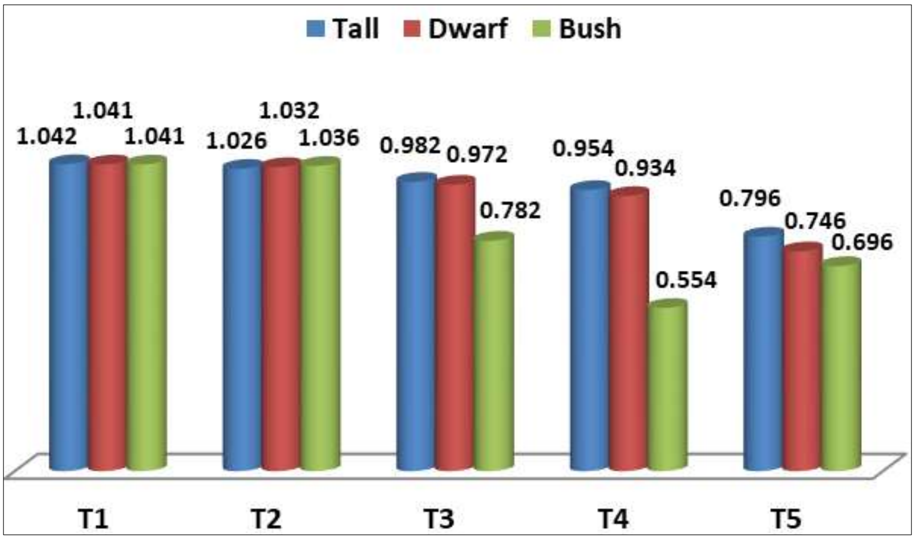

Fig 7: Graphical representation of calcium content in leaf during spring 2019

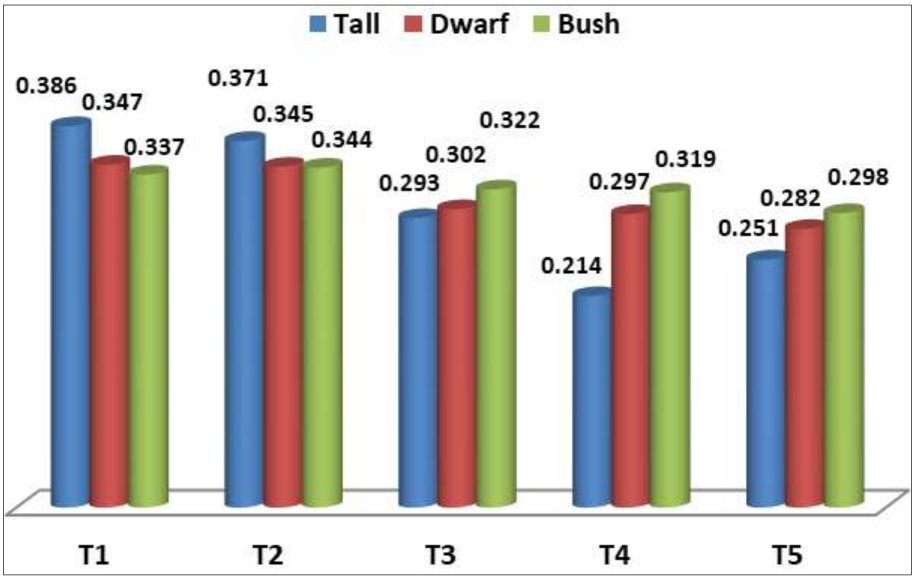

Fig 8: Graphical representation of magnesium content in leaf during spring 2019

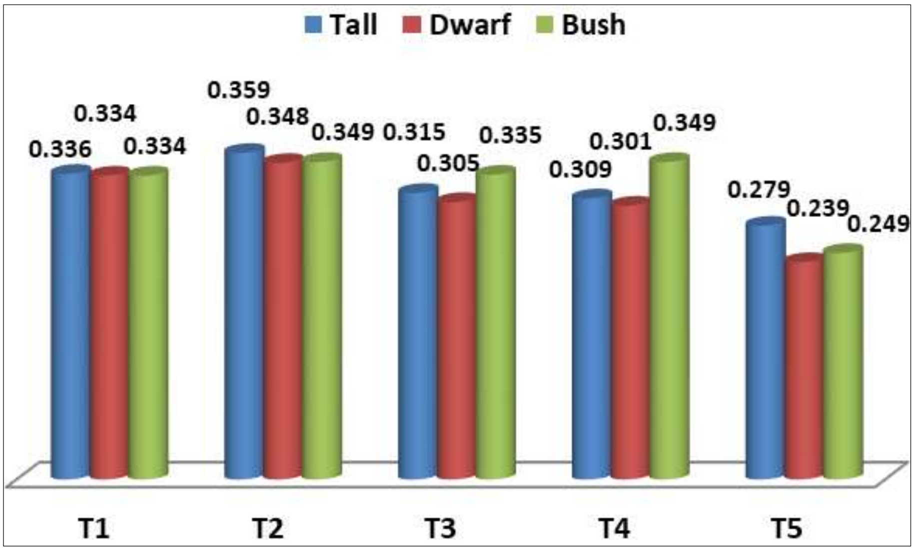

Fig 9: Graphical representation of sulfur content in leaf during spring 2019

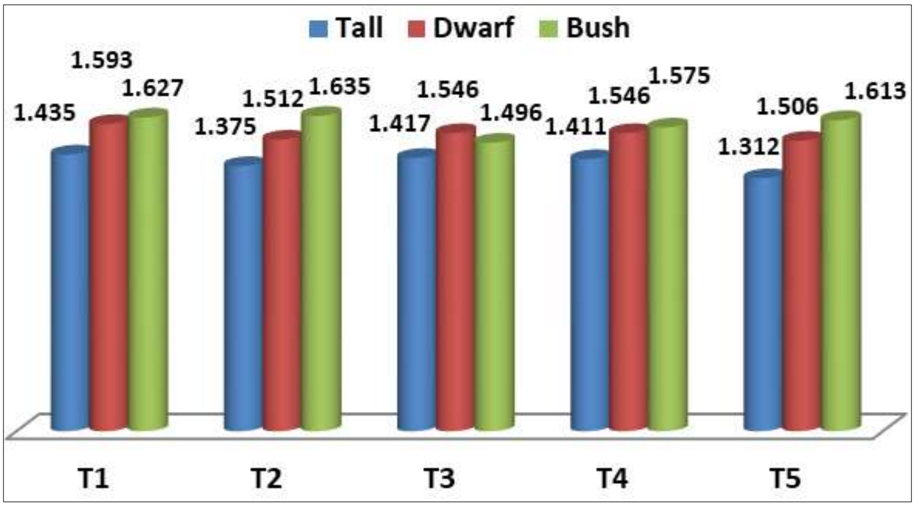

Fig 10: Graphical representation of calcium content in leaf during autumn 2019

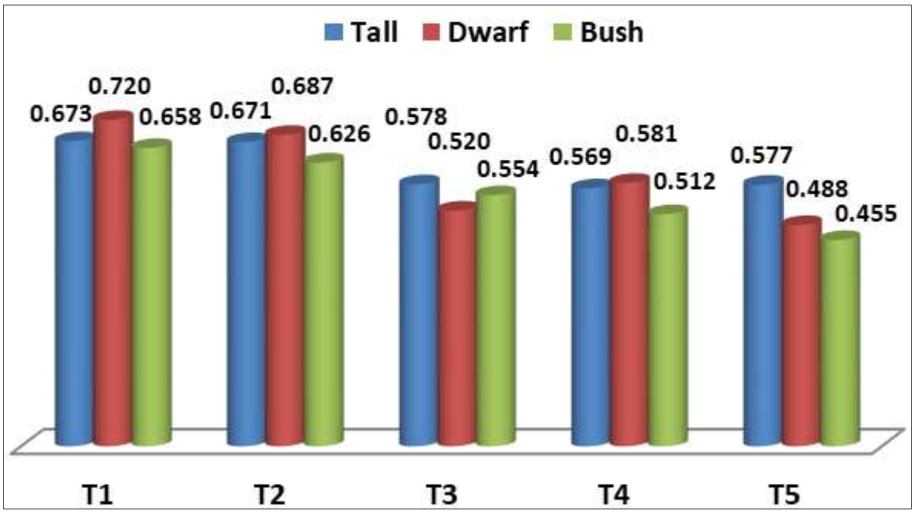

Fig 11: Graphical representation of magnesium content in leaf during autumn 2019

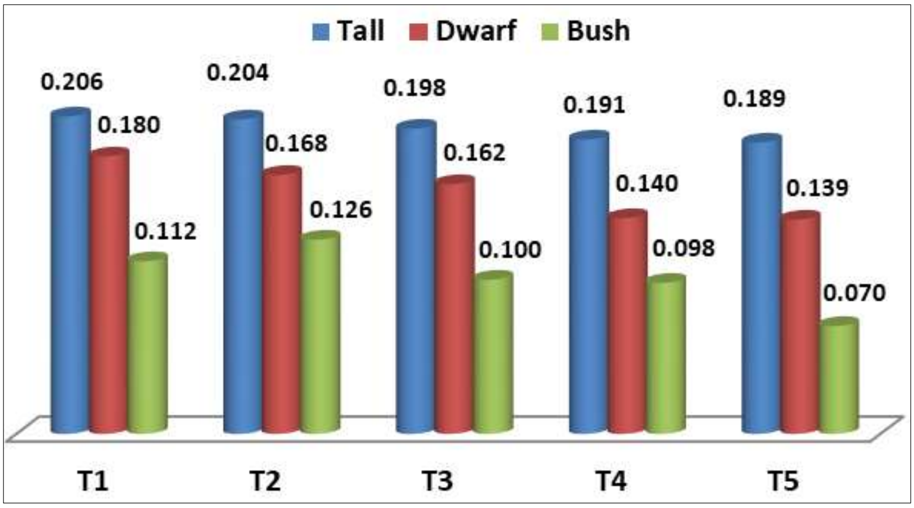

Fig 12: Graphical representation of sulfur content in leaf during autumn 2019

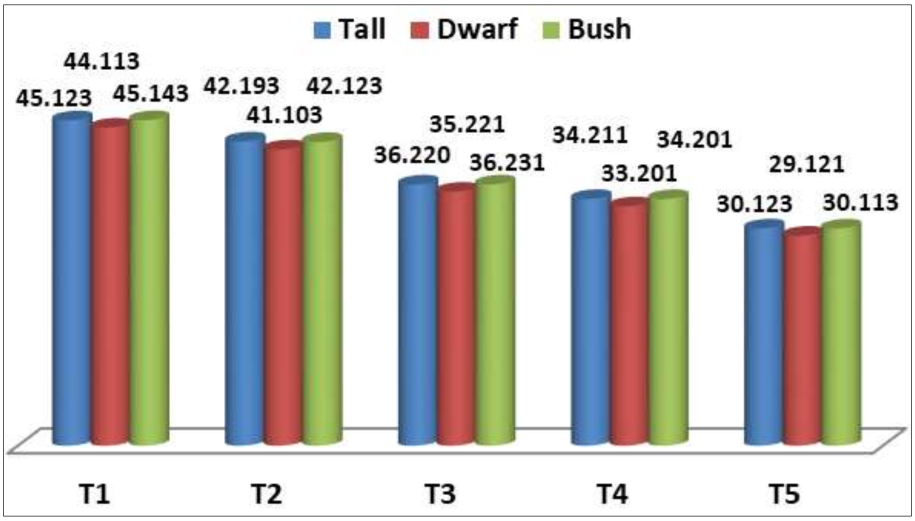

Fig 13: Graphical representation of zinc content in leaf during spring 2019

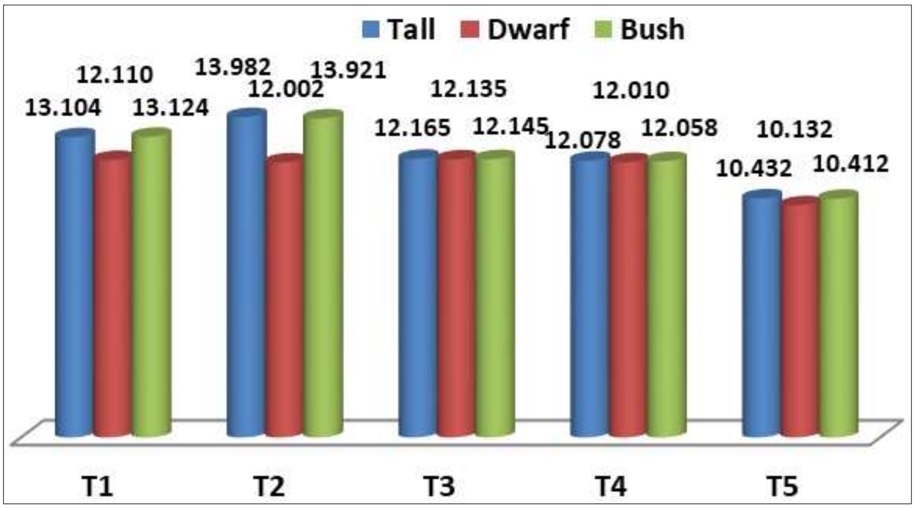

Fig 14: Graphical representation of copper content in leaf during spring 2019

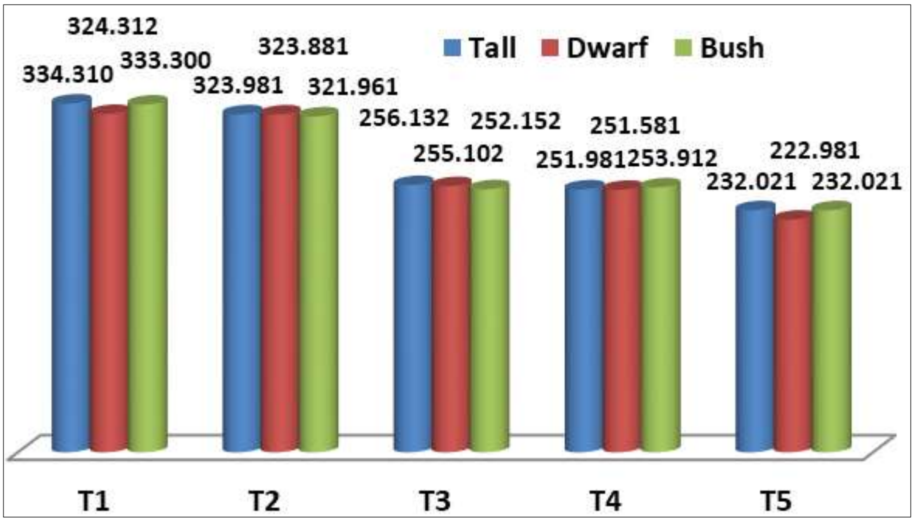

Fig 15: Graphical representation of iron content in leaf during spring 2019

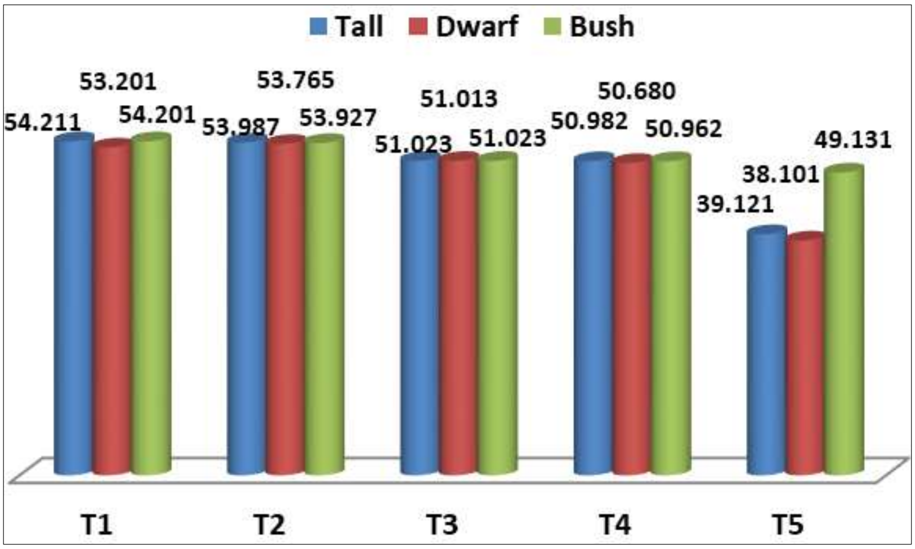

Fig 16: Graphical representation of manganese content in leaf during spring 2019

Fig 17: Graphical representation of zinc content in leaf during autumn 2019

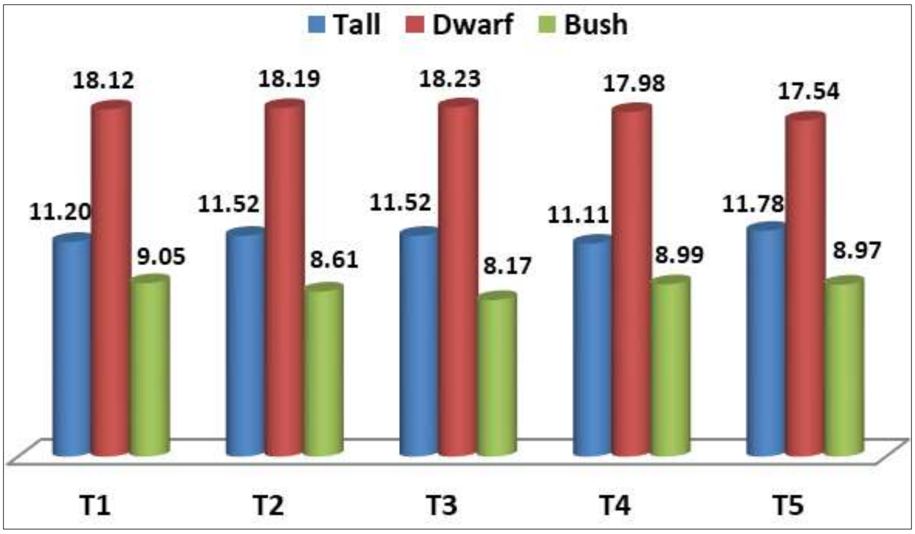

Fig 18: Graphical representation of copper content in leaf during autumn 2019

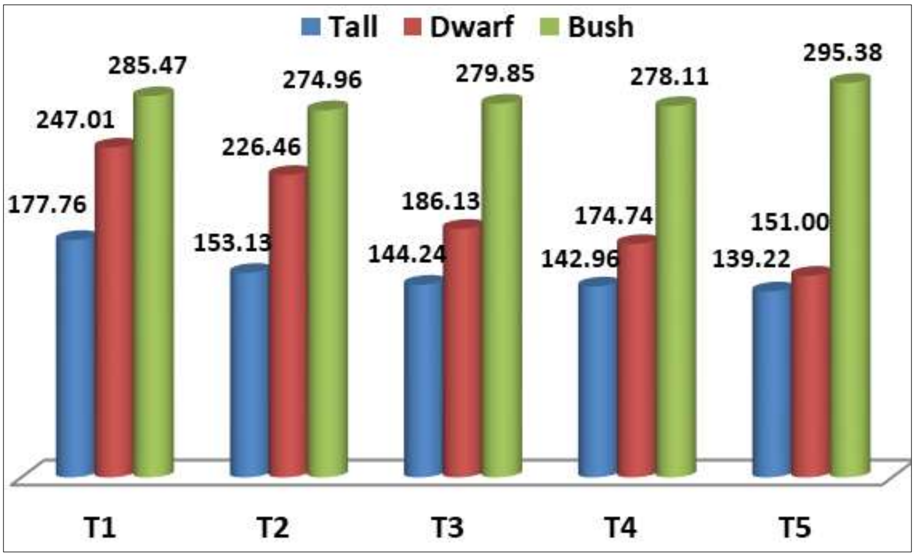

Fig 19: Graphical representation of iron content in leaf during autumn 2019

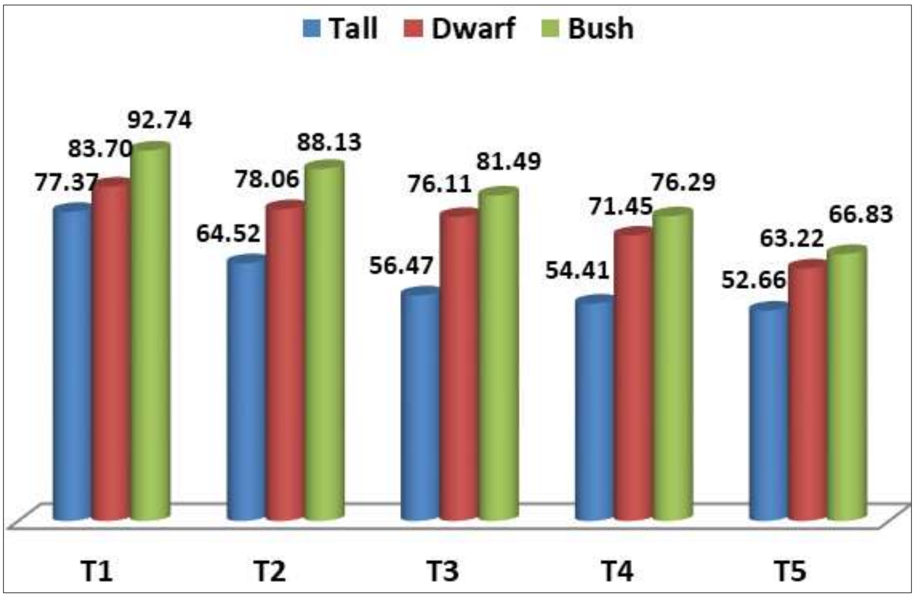

Fig 20: Graphical representation of manganese content in leaf during autumn

4. Discussion

Mulberry leaf quality has a profound influence on silkworm rearing and as such plays a predominant role in healthy growth of silkworms (Bongale and Chaluvachari, 1997 [2]; Purohit and Pavan Kumar, 1996 [11]; Rachotaiah *et al*., 2002) [12]. The leaf in turn gets its nutrients from the soil which is being enriched through proper and timely fertilizer application that too when plants need them most for luxuriant growth and overall sustenance. Nitrogen, phosphorous& potassium% in leaf was influenced by application of varied fertilizer doses in a split manner. Significantly highest% of N was found in tall & dwarf mulberry plantation in treatment T1 which was however at par with T2. Same was holding good in respect of phosphorous. In tall and dwarf type of plantation potassium also indicated similar results with respect to dwarf plantation. Increased macronutrient content in respect of T1 is due to application of split fertilizer doses. Almost similar results were obtained with regard to calcium, magnesium, sulfur and other micronutrients including zinc, copper, iron and manganese. The results are in conformity with the findings of Nakajima (1975) [9]; Singhal *et al*. (2006) [14]. As such the split application of fertilizer dose not only helps in crop improvement but also quality production of leaf is assured to a greater extent.

5. Conclusion

The outcome of study points to the fact that judicious use of fertilizers and their application to soil at the time when plant needs those most will not only result in reduced input cost of mulberry cultivation but will also yield qualitative mulberry leaf for overall sustenance of sericulture. Increased fertilizer doses over and above the recommended dose does not yield encouraging results only but also increases the cost of cultivation and renders some nutrients unavailable to plants due to change in soil pH. However no fertilizer application drastically reduces quality of mulberry leaf.

6. References

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