Studies on Mineral Nutrient Concentration of different cultivars of Sweet cherry *(Prunus avium L.)* in Kashmir

Abstract

The aim of the study was to investigate the differences in leaf nutrient concentrations among the three cultivars (*Misri, Double and Makhmali)* of Sweet Cherry even though they are grown in same conditions. The other goal of the study was to determine variation in nutrient concentration of sweet cherry grown under different locations. Significant differences between cultivars were observed in nitrogen, calcium, Magnesium and Sulphur content in leaves, whereas phosphorus and potassium contents did not exhibit significant differences among the cultivars under study. The higher Nitrogen content was observed in *Double* and lowest in *Makhmali* cultivar. Higher content of Magnesium and Sulphur content was observed in *Misri* and lowest in *Makhmali* cultivar of sweet Cherry. All the macronutrients under study were significantly affected by the location of the orchards.

Key words: Sweet Cherry, cultivars, Leaf nutrient Concentrations.

Introduction

Sweet Cherry *(Prunus Sativus L.)* is the fruit crop of the valley of Kashmir which comes first in the market among the other temperate fruits and hence fetches a good remunerative price. Among the different cultivars grown in the valley Misri, Double and Makhmali cultivars are cultivated on large scale. Orchard nutrition is a pre harvest and post-harvest practice that affects productivity and fruit quality and has to be performed very carefully as after the harvest, fruit quality cannot be improved. The importance of leaf nutrient analysis for a scheduled fertilizer programme cannot be ignored. Although soil analysis provides the insight of nutrient availability for uptake but leaf analysis provides us with the measure of actual uptake by the plant. Plant nutrient concentration may differ even if they are grown in the same soil conditions *(Kacar, 1995., Bergmann, 1992., Marschner, 1995*). Studies have shown that root stock, plant cultivars

may affect the mineral nutrient concentration (*Roversi et al 2010; Sotirov 2011*). Therefore, nutrient uptake and translocation ability of different plant cultivars must also be taken into account for plant growth because these differences can affect yield and quality (*Gioradno and Mortvedt, 1974*). Also determining plant nutrient uptake capacity is important to know how much nutrient is required for a particular cultivar (*Ibarra-Jimenez et al., 2004*). Although Sweet Cherry being an important crop in the valley has been by and large neglected and is not managed scientifically resulting in low yield and poor quality of the fruit. The studies on the nutritional aspects of this crop has not been satisfactorily dealt and meager information about the nutrient status of this crop is available. Therefore, the present work was undertaken with an aim to study the variations in nutrient concentrations of different cultivars of Sweet Cherry grown in the two districts, Srinagar and Ganderbal, of the Kashmir Valley.

Material and Methods

Study Site

Twelve sweet cherry orchards were selected from different sweet cherry growing areas from the twin districts, Ganderbal and Srinagar of Kashmir valley. District Ganderbal is located at 34^{o}23' N latitude, 74^{0}78' E longitude at an altitude of 1619 m above the mean sea level whereas district Srinagar is located at 34^{0}5'N Latitude and 74^{0}5'E longitude at an altitude of 1585m above mean sea level. The orchards were more than 15 years old growing three cultivars, *Misri, Double and Makhmali*

Soil sampling and Analysis

The soil samples were collected from 12 representative orchards from 4 layers (0-20, 20-40, 40-60 and 60- 80 cm), in order to ensure the effect of feeder roots that are concentrated in deeper soil layers, using manual soil sampling equipments. The soil samples were processed and analyzed for Chemical properties by adopting standard procedures. Soil pH and EC were measured in 1:2.5 soil water suspension by pH meter and EC meter respectively (*Jackson, 1973*). The available macronutrients were determined by using standard procedures like Available N (*Subbbiah & Assija, 1956*), Available P (*Olsen,1954*), Available K (*Jackson, 1973*), Exchangeable Calcium and Magnesium (*Black, 1965*) and available Sulphur (*Chesnin & Yien, 1951*).

Plant sampling and leaf mineral analysis

Leaf sampling was done at 60 DAFB (days after Full Bloom). Healthy, fully developed leaf samples were collected from mid terminal shoots of current season growth (*Chapman, 1964*). Leaf samples were washed and dried outdoors in an airy place for a week. After drying samples in a well ventilated drying oven for 6 hrs at 40^{o}C, the whole sampled material was finely ground and homogenized. Samples were then stored in paper bags in a dark and dry place until use. The leaf samples for N estimation were digested by Sulphuric acid in presence of catalytic mixture whereas for estimation of P, K, Ca, Mg and S the leaf samples were digested in Di-acid (HNO_3 + $HClO_4$ 9:4 ratio). The extracts obtained were analysed for estimation by standard procedures as outlined by *Jackson, 1973*.

Data Analysis.

All results obtained were subjected to analysis of variance (ANOVA) for means separation. (Test at $P \leq 0.05$)

Results and Discussion

Soil

Orchard soils at both the locations were slightly acidic to alkaline in reaction. (Table: 1). The examined soils were noted to be non-saline as inferred from the values of EC (< 1 dS m^{-1}) and Organic carbon was medium to high in range (1.0-1.6 per cent). The soils were medium in available Nitrogen and Phosphorus and high in Available Potassium, Calcium and Magnesium whereas Sulphur was in medium range. These nutrients showed decreasing trend down the profile which may be attributed to the high organic matter content in the surface soil samples than the subsurface soil samples.

Leaf Nutrient Concentrations

Nitrogen

Nitrogen content in all the three cultivars of Sweet Cherry was adequate irrespective of the locations of the orchard which may be attributed to the adequate nitrogen and organic carbon percentage in the soil under study. *Georgiv, 1984 and Ystaas, 1990* also reported the same relationship of soil and plant nutrients. Nitrogen content in all the three varieties of sweet cherry was significantly higher at Ganderbal orchards than at Srinagar orchards. The Double cultivar of

sweet cherry was having significantly higher N content than the Misri and Makhmali. All the three cultivars were having significant differences in N content among each other.

Phosphorus

All the three cultivars of sweet cherry at both the locations showed adequate concentration of phosphorus. The content of Phosphorus in all the three cultivars was significantly higher in the orchards at Ganderbal location. Among the three cultivars phosphorus did not exhibited any significant difference.

Potassium

Adequate concentration of potassium in all the three cultivars of sweet cherry was observed at both the locations. There were no significant differences in potassium concentration exhibited by the three cultivars. *Ganai et al., 1991* also reported the same effect of cultivars on the concentration of Phosphorus and Potassium.

Calcium

Calcium content in the foliage of all the three cultivars of sweet cherry at both Ganderbal and Srinagar orchards were adequate. Misri cultivar of sweet cherry showed higher concentration of Calcium irrespective of the location of the orchard but the content of calcium did not showed significant differences between Double and Makhmali cultivar. Significantly higher concentration of Calcium was observed in the foliage of sweet cherry at Ganderbal location.

Magnesium

The concentration of Magnesium in the foliage of all the three cultivars was adequate sampled at both Ganderbal and Srinagar. Significantly higher concentration of Magnesium was observed in all the three cultivars of sweet cherry at Ganderbal. Magnesium content in the foliage of Misri cultivar was significantly higher than the other two cultivars and all the three cultivars exhibited significant differences in the Mg concentration. The lowest concentration of Mg was observed in Makhmali cultivar.

Sulphur

As with the other macronutrients sulphur content was also adequate in all the three cultivars irrespective of the locations of the orchards. Significantly higher concentrations Sulphur were observed in Ganderbal orchards than that of Srinagar. Misri and Double cultivars were not having significant differences in their Sulphur content but both Misri and Double cultivars were having significant differences with that of Makhmali cultivar.

The adequate amounts of all the leaf nutrient concentrations of sweet cherry in all the three cultivars under study could be attributed to the adequate fertility status of the soils which could be understood by the high organic carbon percentage of soils at both the locations. Strong correlation between soil fertility status and leaf nutrient concentrations was also reported by *Cossandro et al., 2008.*

The significant differences in the nutrient contents of sweet Cherry cultivars can be explained with the genetic effect leading to different nutrient uptake capacity, which was also reported by *Kucukyumuk and Erdal, 2011* while studying the effect of cultivars of Apple on their nutrient concentrations. Similarly, *Nagy et al., 2006* explained the same phenomenon for the differential uptake of nutrients by different cultivars of Apple.

Conclusion

In view of the above observations, it can be summed up that nutrient concentrations in a plant seems to be the result of interaction between its genetic inheritance and the environment in which it grows. This indicates that both soil and plant or leaf analysis are important tools for studying the nutritional status of fruit orchards.

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Table1. Result of Chemical Analysis of Soils at two locations.

Location	Parameter	Depth (cm)			
		0-20	**20-40**	**40-60**	**60-80**
Ganderbal	**pH**	6.7	6.6	6.6	6.3
	EC (dS m^{-1})	0.21	0.23	0.21	0.22
	OC (%)	1.6	1.2	1.0	1.0
	N (mg kg^{-1})	161.1	129.1	111.3	98.1
	P (mg kg^{-1})	8.9	8.0	7.1	6.0
	K (mg kg^{-1})	169.1	151.1	143.2	128.3
	Ca (mg kg^{-1})	1965	2001	2050	2060
	Mg (mg kg^{-1})	424	390	391	380
	S (mg kg^{-1})	9.4	9.3	9.2	9.0
Srinagar	**pH**	6.9	6.3	6.5	6.2
	EC (dS m^{-1})	0.22	0.21	0.23	0.23
	OC (%)	1.5	1.1`	1.1	1.0
	N (mg kg^{-1})	155.6	121.5	99.7	95.2
	P (mg kg^{-1})	8.6	7.9	7.8	7.5
	K (mg kg^{-1})	160.1	143.2	131.6	120.7
	Ca (mg kg^{-1})	1862	1998	2001	2022
	Mg (mg kg^{-1})	418	375	361	343
	S (mg kg^{-1})	9.1	8.9	8.3	8.0

Table 2: Leaf nutrient concentration (%) of different cultivars of Sweet Cherry.

Nutrient	Location	Cultivars		
		Misri	**Double**	**Makhmali**
Nitrogen (%)	**Ganderbal**	2.38a**	2.41b	2.32c
	Srinagar	2.10b	2.39c	2.21d
Phosphorus (%)	**Ganderbal**	0.148a*	0.149a	0.147a
	Srinagar	0.146b	0.147b	0.145b
Potassium (%)	**Ganderbal**	1.68a	1.71a	1.66a
	Srinagar	1.63b	1.67b	1.62b
Calcium (%)	**Ganderbal**	1.60a	1.57b	1.57b
	Srinagar	1.58b	1.56c	1.55c
Magnesium (%)	**Ganderbal**	0.49a	0.48b	0.47c
	Srinagar	0.47b	0.46c	0.45d
Sulphur (%)	**Ganderbal**	0.36a	0.36a	0.35b
	Srinagar	0.37b	0.38b	0.36c

***** Difference between the same letters in rows and columns are non-Significant.

**Difference between the values followed by separate letters in rows and columns are Significant.

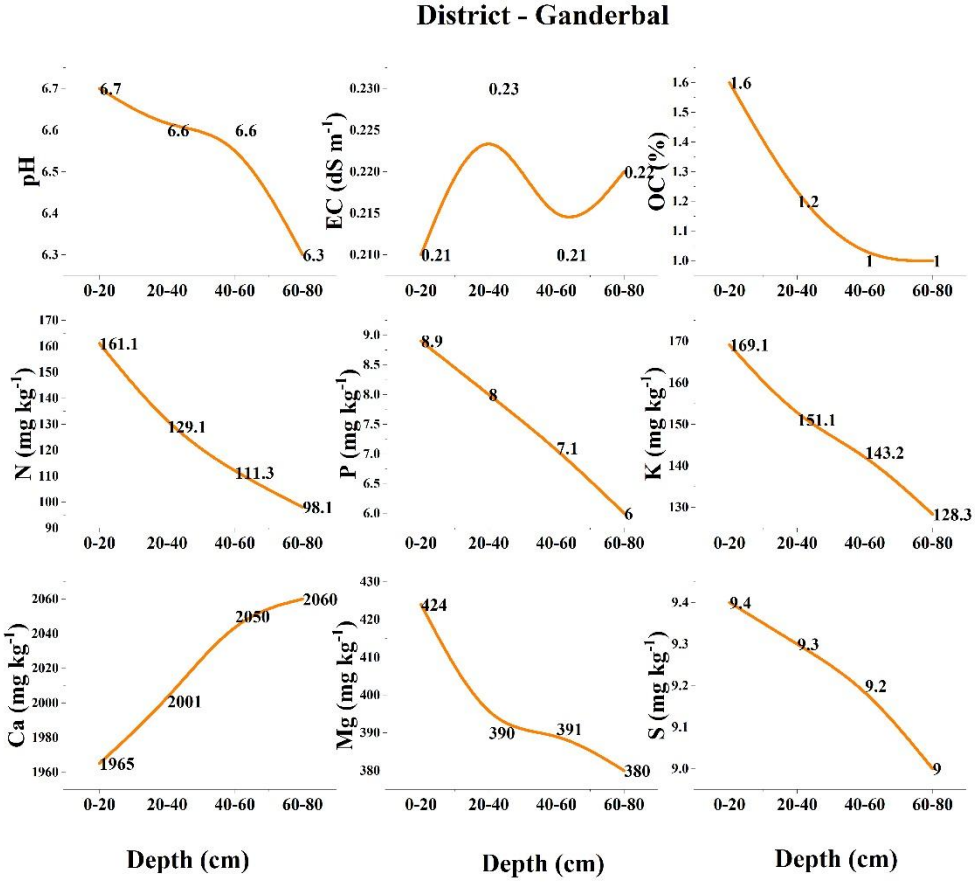
District - Ganderbal
pH
6.7
6.6
6.6
6.3
EC (dS m-1)
0.23
0.21
0.21
0.22
OC (%)
1.6
1.2
1
1
N (mg kg-1)
161.1
129.1
111.3
98.1
P (mg kg-1)
8.9
8
7.1
6
K (mg kg-1)
169.1
151.1
143.2
128.3
Ca (mg kg-1)
1965
2001
2050
2060
Mg (mg kg-1)
424
390
391
380
S (mg kg-1)
9.4
9.3
9.2
9
0-20
20-40
40-60
60-80
Depth (cm)

Fig.1

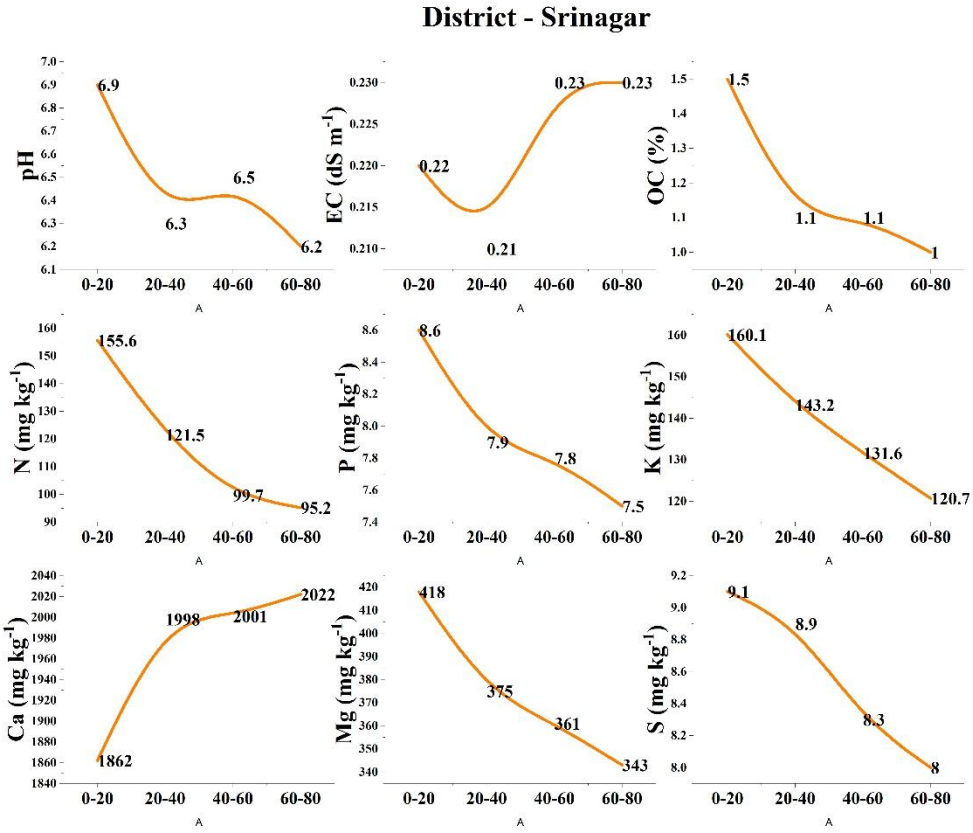
District - Srinagar
pH
6.9
6.3
6.5
6.2
EC (dS m-1)
0.22
0.21
0.23
0.23
OC (%)
1.5
1.1
1.1
1
N (mg kg-1)
155.6
121.5
99.7
95.2
P (mg kg-1)
8.6
7.9
7.8
7.5
K (mg kg-1)
160.1
143.2
131.6
120.7
Ca (mg kg-1)
1862
1998
2001
2022
Mg (mg kg-1)
418
375
361
343
S (mg kg-1)
9.1
8.9
8.3
8
0-20
20-40
40-60
60-80
A

Fig. 2