

Original Research Article

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Nutrient Index of Grapevine Petiole and Soil in Grape Growing Areas of Maharashtra

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ABSTRACT

Keywords

Grapes, Nutrient status, Petiole and soil

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The present study confirms the nutrients status in four grape growing regions of Maharashtra was worked out in the investigation. The available nutrient content was divided in three groups, low, optimum and high. It was revealed from the study that most of the soils are alkaline in reaction in all the four regions. The highest concentration of nitrogen was recorded in Pune region and the lowest average N content was recorded in Nashik region. The K content of the vineyards from Solapur and Sangli region was recorded above the optimum level. The highest average Calcium concentration was found in Sangli region. However, the vineyards from Pune, Solapur and Sangli regions recorded the Ca concentration above the optimum level. The average concentration of Magnesium in petiole at bloom time was found slightly less than the optimum level in all four main grape growing regions. The concentration of Fe in all the regions was found to be at higher level. The concentration of Mn, Zn also Cu were found to be more than optimum in most of the vineyards from all the four regions. Toxicity of sodium was noticed in Pune Solapur and Sangli region. The problem of high concentration of sodium in petiole was noticed in Sangli (90.11%), followed by Solapur (89.68%), and Pune (85.95%). However, in Nashik region most of the vine yards were found to be safe from sodium toxicity.

Introduction

Grape is one of the major fruit crop. In India, Maharashtra is the leading state in grape production. Within Maharashtra Nasik is a major grape growing district, followed by Sangli, Solapur and Pune. In all about 3.0 lakh/ha of land is under grape cultivation. The area under grape cultivation is on an increase owing to the good yield and monetary gains after the export. The yield depends on many factors viz., quality of soil, judicious manuring and efficient viticultural practices.

Soil analysis for the nutrient availability is an essential part in viticulture but petiole analysis is vital because the availability of nutrients in soil does not essentially correspond to the optimum levels of the nutrients in the tissue. Soil analysis should be done prior to planting to determine organic matter, pH level, lime requirement, NPK and micronutrient requirements. Petiole tissue recommended for determining the nutritional status of the grape vine. Petiole analysis is the most reliable method to determine the fertilizer needs for established vineyards. Soil

samples as well as petioles samples were collected from the vineyards of Nasik, Sangli, Pune and Solapur were analyzed for their nutrient index.

Materials and Methods

Soil samples and petiole samples were collected from the four grape growing areas (Nasik, Sangli, Solapur and Pune) of Maharashtra and brought to the laboratory of MRDBS, Pune. Soil samples were collected after April and October pruning during the year of 2017-18. The leaf petioles opposite to the cluster were collected forty-five days after fruit pruning as per the standard technique suggested by Chapman (1964). The petioles were separated from the leaf blades immediately after collection, placed in polythene bags and brought to the laboratory. After washing with 0.1N HCl, they were subsequently washed with distilled water to remove the traces of acid, the samples were oven dried and ground to fine powder.

Determinations

Soil samples were analysed for various parameters in the laboratory. pH and conductivity was measured by pH meter, CaCO₃ by Titrimetric method, Organic Carbon was estimated titrimetrically as described by (Walkley and Black). Available nitrogen by alkaline potassium permanganate method as described by Subbiah and Asija (1956), Available Phosphorus by Olsen *et al.*, 1954. Available Potassium was estimated by Jackson, HLS Tondon, available calcium, available Sulphur, available Magnesium. Petiole samples were wet digested with diacid mixture of Nitric acid and perchloric acid in the ratio 3:1. The samples post digestions were analyzed for various nutrients. The Nitrogen was estimated by Micro-Kjeldhals distillation method, phosphorus by vanamolybdate phosphate yellow colour

method. Potassium was estimated by flame photometer. Calcium, Magnesium, and other micronutrients were estimated by Atomic Absorption Spectrophotometer.

Results and Discussion

The distribution of fertility status in four grape growing regions was worked out. The available nutrient content was divided in three groups, low, optimum and high. The percent soil samples lying within the group are given in the Table 1. It was revealed from the table that most of the soils are alkaline in reaction in all the four regions. The highest number (84.22 %) of soil samples from Sangli region were found to be alkaline, followed by Solapur (68.81 %). The highest numbers of samples (90.79 %) from Pune region were found to be calcareous to highly calcareous in nature. About 24.16 % soil samples from Nashik region were found to be low in organic carbon content. About 9.04 per cent grape gardens from Solapur region, 19.74 per cent soils from Pune region and 5.36 per cent soils from Sangli region were also found to be low in Organic Carbon content. With regards to major nutrients, 8.04 per cent soil samples from Sangli region and 40.13 per cent soils from Pune region were found to be low in available N and P content respectively. The highest numbers of soil samples i.e.54.26 per cent in Solapur region were found to be optimum in available potassium. The Calcium and Magnesium content in almost all soil samples (99.38 to 100 %) was found to be at higher level. The highest numbers of soil samples i.e., 24.11 per cent in Sangli region were found to be low in available Fe. Whereas 29.46 per cent soil samples from Sangli region were recorded at optimum level in available Mn. The available Zinc was found to be low in 26.06 per cent soil in Solapur region among the rest of region. The problem of sodicity was noticed in 13.15 per cent soils in Pune region followed by 11.61 per cent in Sangli region.

Table.1 Soil fertility Status of the vineyards from four grape growing regions of Maharashtra

Parameter	Nashik (981)		Pune (152)		Solapur (188)		Sangli (112)	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
pH	--	4.77 – 8.68	--	4.92 – 9.30	--	6.81 – 8.80	--	5.95 – 8.64
EC (dSm⁻¹)	0.62	0.05 – 2.83	0.39	0.10 – 2.72	0.45	0.09 – 2.80	1.39	0.21 – 3.05
CaCO₃ (%)	8.31	1.38 – 27.57	5.77	0 – 25	9.62	1.00 – 77	9.28	1 – 29
Organic carbon %	1.68	0.16 – 6.85	0.99	0.20–15.39	1.37	0.05 – 5.8	1.55	0.20 – 6.28
Av. N (ppm)	242.31	60.84–833.89	835.11	52 – 331	124.8	18 – 711	141.36	63 – 380
Av. P (ppm)	55.73	2.76 – 236.94	57.33	1 – 494	44.94	1 – 316	54.86	2 – 308
Av. K (ppm)	457.09	12.03-2241.54	404.14	50 – 4200	489.13	70 – 6000	462.43	70 – 3300
Av. Ca (ppm)	6147.34	685.19- 15164	2982.38	375 – 12525	829.10	1600 – 13875	5902	2025-10650
Av. Mg (ppm)	1280.00	401.97–2376.55	694.52	200 – 2675	1303.9	100 – 2600	1382	300 – 2800
Av. S (ppm)	80.00	3.01 – 274.70	147.68	4 – 1660	113.26	2 – 743	187.06	10 – 1497
Av. Fe (ppm)	10.83	0.61 – 160.76	4.58	0.92–31.60	5.86	0.26 – 26	5.33	0.25–26.42
Av. Mn (ppm)	8.81	0.48 – 31.30	5.29	1.92–32.52	11.87	1.60 – 40.30	8.88	1.27–27.77
Av. Zn (ppm)	3.28	0.13 – 23.83	2.66	0.35–11.90	2.55	0.31 – 10.75	2.99	0.35 – 11
Av. Cu (ppm)	6.46	0.31 – 38.49	11.51	0.72 – 23.08	5.81	0.67 – 34.77	7.14	1.27 – 20.75
Exch. Na (ppm)	282.54	22.07 – 1713	405.22	70 – 7500	751.82	210 – 5400	684.77	350 – 1600

Table.1 Distribution of soils on the basis of availability of nutrients

Parameter	Nashik (981)			Pune (152)			Solapur (188)			Sangli (112)		
	Acidic	Optimum	Alkaline	Acidic	Optimum	Alkaline	Acidic	Optimum	Alkaline	Acidic	Optimum	Alkaline
pH	8.36	27.73	63.91	2.63	29.61	67.76	--	31.38	68.81	0.89	14.29	84.82
EC (dSm⁻¹)	Optimum	High	--	Optimum	High	--	Optimum	High	--	Optimum	High	--
	87.77	12.23	--	69.74	30.26	--	94.15	5.85	--	89.29	10.71	--
CaCO₃ (%)	N.C.	C.	H.C.	N.C.	C.	H.C.	N.C.	C.	H.C.	N.C.	C.	H.C.
	--	61.06	38.94	3.29	5.92	90.79	3.19	48.94	47.87	2.67	49.56	48.21
Organic carbon %	Low	Optimum	High	Low	Optimum	High	Low	Optimum	High	Low	Optimum	High
	24.16	47.40	28.44	19.74	44.08	36.18	9.04	32.98	57.98	5.36	26.79	67.86
Av. N (ppm)	28.75	50.45	20.80	55.26	43.42	1.32	13.30	68.62	18.09	8.04	56.25	35.71
Av. P (ppm)	56.68	24.57	18.76	40.13	13.82	46.05	71.81	17.02	11.17	63.39	17.85	18.75
Av. K (ppm)	23.75	43.43	32.82	10.53	28.94	63.53	18.09	54.26	27.66	25.00	42.86	32.14
Av. Ca (ppm)	--	0.41	99.59	1.30	--	98.68	--	--	100	--	--	100
Av. Mg (ppm)	--	0.71	99.29	1.30	1.30	97.37	0.53	0.53	98.94	--	0.89	99.11
Av. S (ppm)	5.10	45.46	49.44	7.24	28.95	63.81	11.17	39.89	48.94	0.89	31.25	67.86
Av. Fe (ppm)	6.01	20.49	73.50	10.53	28.95	60.53	21.28	34.04	44.68	24.11	38.39	37.50
Av. Mn (ppm)	11.31	24.67	64.02	0.66	21.05	78.29	1.06	13.82	85.11	0.89	29.46	69.64
Av. Zn (ppm)	15.39	71.15	13.43	11.84	40.79	47.37	26.06	61.17	12.77	16.07	69.64	14.29
Av. Cu (ppm)	--	0.51	99.49	--	--	100	--	86.17	13.82	--	--	100
Exch. Na (ppm)	Optimum	Harmful	--	Optimum	Harmful	--	Optimum	Harmful	--	Optimum	Harmful	--
	97.96	2.04	--	86.84	13.15	--	87.24	12.77	--	88.39	11.61	--

* NC – Non Calcareous, C – Calcareous, H.C. – Highly Calcareous

Table.2 Petiole nutrient status at bloom time stage of four grape growing regions of Maharashtra

Parameter	Nashik (792)		Pune (121)		Solapur (155)		Sangli (140)	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Nitrogen (%)	1.55	0.61 – 4.26	2.29	0.96 – 4.20	1.75	0.78 – 4.53	1.60	0.78 – 4.03
NO ₃ – N (ppm)	1683.33	150.81 – 7538	1178	159 – 3920	1054	347 – 3195	1068	468 – 5601
Phosphorous (%)	0.53	0.08 – 1.97	0.32	0.10 – 0.78	0.39	0.14 – 0.81	0.39	0.15 – 0.84
Potassium (%)	2.41	0.12 – 5	2.11	0.60 – 3.84	3.11	0.75 – 5.40	3.01	0.50 – 6.60
Calcium (%)	1.15	0.22 – 4.25	1.21	0.20 – 4.46	1.38	0.63 – 3.86	1.42	0.76 – 3.37
Magnesium (%)	0.40	0.08 – 5.00	0.40	0.15 – 0.86	0.48	0.04 – 1.07	0.49	0.15 – 0.93
Sulphur (%)	0.14	0.037 – 0.81	0.22	0.04 – 0.86	0.16	0.05 – 0.37	0.15	0.05 – 0.46
Iron (ppm)	194	27 – 1226	334	27 – 2133	108	33 – 710	150	18 – 1192
Manganese (ppm)	96.48	5 – 852	232	9.62 – 1339	145	29 – 659	156	13 – 995
Zinc (ppm)	64.69	11 – 333	97	8 – 292	100	10 – 324	115	8 – 298
Copper (ppm)	22.15	1 – 209	39	2 – 199	26	2 – 162	50	1.361
Sodium (%)	0.27	0.025 – 2.02	0.97	0.3 – 2.70	0.95	0.30 – 2.30	0.98	0.1 – 2.70

Table.2 Classification of vineyards based on petiole nutrient status from all four regions (per cent)

Parameter	Nashik (792)			Pune (121)			Solapur (155)			Sangli (140)		
	L - D	O	H - VH	L - D	O	H - VH	L - D	O	H - VH	L - D	O	H - VH
Nitrogen (%)	25.51	67.68	6.82	14.88	48.76	36.36	17.42	70.32	12.25	37.86	50.00	12.11
NO ₃ – N (ppm)	4.55	18.94	76.52	2.48	16.53	80.99	0.65	33.55	65.81	--	45.00	55.00
Phosphorous (%)	33.71	49.62	16.67	65.29	33.88	0.83	45.81	51.61	2.58	50.71	47.86	1.43
Potassium (%)	5.18	37.75	57.07	9.09	47.93	42.98	2.58	12.90	84.52	2.86	17.14	80.00
Calcium (%)	19.57	36.87	43.56	13.22	36.36	50.41	1.94	33.55	64.51	--	35.00	65.00
Magnesium (%)	79.17	19.07	1.77	79.34	19.83	0.83	62.58	30.32	7.09	54.29	41.43	4.29
Sulphur (%)	57.83	34.47	7.70	33.06	41.32	25.62	23.23	72.26	4.52	45.71	47.14	7.14
Iron (ppm)	0.13	9.34	90.53	0.83	12.40	86.78	--	44.51	55.48	1.42	30.71	67.86
Manganese (ppm)	48.99	37.75	13.26	30.58	36.36	33.06	18.71	62.58	18.71	20.71	50.00	29.29
Zinc (ppm)	44.82	49.49	5.68	37.19	40.50	22.31	7.74	79.35	12.90	9.29	52.14	38.57
Copper (ppm)	9.09	27.90	63.01	4.13	13.22	82.64	3.87	25.83	70.32	7.85	10.00	82.14
Sodium (%)	85.48 Safe	14.52 Unsafe	-	14.05 Safe	85.95 Unsafe	-	10.32 Safe	89.68 Unsafe	-	9.29 Safe	90.71 Unsafe	-

L – Low, D – Deficient, O – Optimum, H – High, VH – Very High

The average concentration of nutrients and the range of nutrients at bloom time from the samples collected from Nashik, Pune, Solapur and Sangli regions are given in Table 2 and the classification of vineyards based on nutrient status in the petiole is given in Table 3. The highest concentration of nitrogen (2.29 %) was recorded in Pune region and the lowest average N content (1.53%) was recorded in Nashik region. The highest NO₃ – N (1683.33 ppm) was recorded in Nashik region. The vineyards from Pune (0.32%), Solapur (0.39%) and Sangli (0.39%) regions recorded the P concentrations. The K content of the vineyards from Solapur (3.11%) and Sangli (3.01%) region was recorded above the optimum level. The highest average Calcium concentration (1.42%) was found in Sangli region. However, the vineyards from Pune, Solapur and Sangli regions recorded the Ca concentration above the optimum level.

The average concentration of Magnesium in petiole at bloom time was found slightly less than the optimum level in all four main grape growing regions. The concentration of Fe in all the regions was found to be at higher level. The concentration of Mn, Zn also Cu were found to be more than optimum in most of the vineyards from all the four regions. Toxicity of sodium was noticed in Pune Solapur and Sangli region.

The classification of vineyards on the basis of nutrient status as reported in Table 3. It is revealed that the concentration of N in most of the vineyards were at optimum level. The vineyards from all the four regions were found to be high to very high in concentration of NO₃ – N. regarding the concentration of Phosphorus, Nashik (49.62%) and Pune (33.88%) were found to be at optimum level of P. Maximum number of vineyards (50.91 %) were found to be low to deficient in P content in Sangli region. Optimum concentration of Potassium was noticed in

Pune. However, in Nashik region (57.07%), Solapur (84.52%) Sangli (80.00%) vineyards recorded high to very high concentration of K. Most of the vineyards from Nashik (43.56%) and Solapur (65.51%), Pune (50.41%), Sangli (65.00%) regions were found to be high to very high in respect of Ca concentration. Deficiency of Magnesium was noticed to the tune of 79.34 per cent vineyards in Pune regions followed by 79.17 per cent in Nashik, 62.58 per cent in Solapur region. In general, the vineyards through Maharashtra were found to be deficient with Magnesium in concern. The concentration of Fe was found to be at higher level in all the vineyards of Maharashtra. The highest concentration of Mn (33.06 %) was recorded in Pune region. All most all the vineyards were found to be optimum in respect of Zn. The toxicity of Cu was observed in all the four regions. The problem of high concentration of sodium in petiole was noticed in Sangli (90.11%), followed by Solapur (89.68%), and Pune (85.95%). However, in Nashik region most of the vine yards were found to be safe from sodium toxicity.

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