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EFFECT OF ACCUMULATION OF SALTS IN SOIL THROUGH IRRIGATION WATER ON GRAPE GARDENS OF WESTERN MAHARASHTRA

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Abstract: *The present investigation on "Assessment of accumulation of salts in soil through irrigation water in grape gardens of western Maharashtra" was carried at Division of Soil Science and Agril. Chemistry, College of Agriculture, Pune and Maharashtra Draksh Bagayatdar Sangh (M.R.D.B.S.), Manjri, Pune during 2013-14. The study consist of comparison in the quality of irrigation water and thereby accumulation of salts in soil during the year 2007-08 to 2013-14 in four grape growing regions viz; Pune, Nashik, Sangli and Solapur of Western Maharashtra. The region wise soil samples were collected. The total soil samples 1650 including 179 from Pune, 1050 from Nashik, 107 from Sangli and 314 from Solapur were collectedduring 2007-08 and considered as baseline in this study. The total 892 soil samples including 391 from pune, 40 from Nashik, 217 from Sangli and 244 from Solapur were collected in the year 2013-14. The salt accumulation in soils of grape gardens of Sangli region was higher in 2013-14 than 2007-08. The accumulation of chloride varied from region to region and it was noticed that during 2007-08 the highest accumulation of chloride was seen in Sangli and it was continuously increased up to 2013-14.*

Water is essential to the existence of man and all living things (Deshpande and Aher 2012). Decreasing trend of precipitation in recent years has deteriorated ground water quality in terms of increased soluble salts. Grape vines are sensitive to high levels of soluble alts and toxic ions in both soil and irrigation water (Bhargava et al. 2006). It is often intentionally grown under a water deficit to meet wine quality goals (Shellie 2012). Commercial viticulture in India is hardly a few decades old and major grape growing states are Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Punjab and Haryana (Yogeeshappaet al. 2013). The area under grape in country is 117.6 thousand ha with a total production 2,483.1 thousand ton and productivity of 21.1 (Annonymous, 2013a). Among all the grape growing states, Maharashtra occupies the largest area with 90 thousand ha area under the crop with 2050 thousand tone production and 22.8 t ha^{-1} (Annonymous 2013b). Among the state Nashik and Sangli district are forefront with Pune, Satara, Solapur, Ahmednagar, Osmanabad, Latur districts are also under cultivation.

Key word: *Assessment, accumulation of salts, Irrigation water, Grape garden, Western Maharashtra.*

Grape is an irrigated crop, although its growing is limited to rain shadow area of the country and ground water is the major source of irrigation. Above ground drip is the most widely used irrigation method for wine grape and it facilitates manipulation of vine water status by providing temporal and spatial control of the wetted area within a vine row. Reduced soil moisture, resulting from deficit irrigation, decreases vine nutrient uptake by reducing the transpiration stream and by limiting diffusion of nutrients to root surfaces. Thus, quality of irrigation water is important consideration before planting vines and later for its production and quality. The good quality water is an important consideration in the appraisal of salinity and alkalinity in irrigated areas. Therefore this study is planned to assess the quality of irrigation water used in viticulture.

Irrigation is essential for profitable table grape production. Increase in salinity is a major problem for grape cultivation. Grapes are grown in such areas where summers are dry and good suited for good quality vinifera. In such areas evapotranspiration exceeds the precipitation, so irrigation is very much essential. Excess salts affects

the growth production and soil salinity. Soluble salts damage plants through osmotic effect. Salts in irrigationcan desiccate leaf tissue when applied to foliage. Salt deposited on crops can cause leaf and fruit discolouration, reducing market value. Therefore, assessment of quality of the irrigation water is necessary for judicious use of irrigation water and to obtain a sustainable crop yield.

Materials and Methods

One thousand six hundred fifty soil samples were collected and analysed during 2007-08 and eight hundred ninety twosoil samples were collected and analysed during 2013-14 from different grape growing regions of western Maharashtra such as Pune, Nashik, Sangli and Solapur. Irrigation water sources included mainly bore wells, open wells and canals. Analysis was done in the laboratory of Maharashtra State Grape Growers' Association (M.R.D.B.S.) and Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune. The soil samples collected by the student with the help of staff of M.R.D.B.S., Laboratory, Manjri, District Pune during 2013-14.The data on analysis of 2007-08 from M.R.D.B.S laboratory, Manjri, District Pune was takento compare the analysis done during 2013-14. The soil samples collectedwere analysed as per standard methods. The total soluble salts was calculated by multiplying value of EC with 640.

Result and Discussion

The total soluble salts added through water into soil were calculated with the help of EC of water samples. The quantity of different nutrients added in soil (kg/acre/year) through irrigation water applied during 2007-08 and 2013-14 (25,00,000 litres/acre) was presented in table-1.The maximum salts were added in Sangli region *i.e.* 1022.77 kg/acre/year in 2007-08 and 1451.92 kg/acre/year in 2013-14 and lowest salts were added in Solapur region (803.37 kg/acre/year) in 2007-08 and Pune region (846.65 kg/acre/year) in 2013-14.

The anions which accumulated in the soil were bicarbonates and chlorides through irrigation. Carbonate was found to be added in very trace amount to the soil. Whereas the bicarbonate added in the soil was in some quantity (Table 1). During 2007-08 it was noticed that in Pune region highest amount of bicarbonates was accumulated in soil through irrigation. However, during 2013-14 it was found that among all the four regions highest amount of bicarbonate wasaccumulated in soil in Sangli region. Accumulation of chloride varied from region to region and it was noticed that during 2007-08 highest accumulation of chloride was seen in Sangli region and it is continuously increased up to 2013-14.

Calcium, magnesium, sodium and potassium these were the major cations present in water and accumulated in soil through irrigation and it was observed that highest quantity of calcium was noticed in soil during both the years 2007-08 and 2013-14 in Sangli region. Yogeeshappa *et al.* (2013) has got similar type of results regarding calcium content in soils of grape garden. Magnesium in different water samples was present in less quantity than calcium. It was noticed that higher accumulation of magnesium in soil was observed during 2007-08 and 2013-14 in Nashik region. Among both the monovalent cations present in water sodium was having higher accumulation then potassium. The content of potassium in irrigation water is less and due to this the accumulation of potassium salt is also very less. Whereas Hundal *et al.* (2009) studied the addition of nutrients in soils through irrigation water samples in different landforms zones of Punjab and it was concluded that average amount of K contributed through irrigation water varies from 8.0 kg ha $^{-1}$to 28.0 kg ha^{-1}. The amount of P added varied from 0.19kg ha^{-1} to 0.36 kg ha^{-1}.

It was seen that in all the four regions the highest sodium accumulated in Pune region as compared to other region but in 2013-14the scenario was changed and Sangli region has got more accumulation of sodium salt through irrigation in their soil in this year. Potassium was higher in soil (5.64 kg/acre/yr) during 2007-08 in Nashik region whereas in 2013-14 the higher quantity of potassium (17.15 kg/acre/yr) was observed in Pune region. Similar type of results were also reported by Hundal *et al.* (2009).

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Table 1: Quantity of different nutrients added in soil (kg/acre/year) through irrigation water applied during 2007-08 and 2013-14

Sr. No	Region	TSS		CO_3^{2-}		HCO_3^-		Cl^-	
		2007-08	2013-14	2007-08	2013-14	2007-08	2013-14	2007-08	2013-14
1	**Pune**								
	Range	96.0-2272.20	83.20-2092.80	T	T	213.50-2623.0	183.0-2074.0	35.50-1615.25	53.25-1455.5
	Average	968.45	846.65	T	T	1098.46	1063.34	483.27	355.49
2	**Nashik**								
	Range	89.6-4531.20	288.0-2233.60	T	T	244.0-6588.0	610.0-1891.0	35.50-2964.5	8.40-397.50
	Average	834.20	968.08	T	T	1016.92	1078.98	417.97	558.60
3	**Sangli**								
	Range	364.80-2438.40	128.0-4710.40	T	T	274.5-1464.0	134.2-2501.0	106.5-2201.0	106.5-4171.25
	Average	1022.77	1451.92	T	T	869.86	1184.0	678.76	872.53
4	**Solapur**								
	Range	51.2-3622.40	147.20-3737.60	T	T	122.0-1586.0	305.0-2562.0	53.25-3496.75	71.0-3106.25
	Average	803.37	1012.23	T	T	898.99	948.61	396.38	556.01

Sr. No	Region	Ca		Mg		Na		K	
		2007-08	2013-14	2007-08	2013-14	2007-08	2013-14	2007-08	2013-14
1	**Pune**								
	Range	22.5-940.0	30.00-674.5	6.60-380.10	12.60-250.5	33.35-829.3	8.63-1409.33	0.49-18.53	0.0-575.2
	Average	270.44	236.22	86.31	80.62	316.56	295.16	3.63	17.15
2	**Nashik**								
	Range	11.00 -1210.0	41.0-660.0	8.40-397.50	24.9-199.80	6.33-2415	37.95-1060.30	0.0-225.23	0.88-17.55
	Average	274.0	265.99	94.96	88.47	177.69	305.68	5.64	3.62
3	**Sangli**								
	Range	36.50-1132.5	39.00-1805.0	15.00 -360.0	15.30-549.0	66.70-725.65	37.95-3214.25	0.29-9.56	0.78-10.73
	Average	2814.8	392.1	68.62	124.68	277.27	520.48	2.01	2.99
4	**Solapur**								
	Range	16.0-1261.50	26.50-1800.0	0.18-306.60	6.30-528.0	7.48-400.70	24.73-2125.20	0.49-25.35	0.49-124.80
	Average	232.66	320.07	66.18	93.27	218.17	331.81	3.28	4.0