Mysore J. Agric. Sci., 51 (3) : 670-674, 2017

Effect of Foliar Application of Zinc Metalosate on Yield and Quality of Grapes (*Vitis vinifera)*

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Abstract

A field experiment was conducted to study the effect of foliar spray of zinc metalosate on yield and quality of grape *var*. Dilkush in the farmer's field at Marganahalli village, Chikkaballapur district. The experiment was conducted with twenty treatments and replicated thrice in Randomized Block Design. Soils of the experimental site were acidic in pH, normal in EC (dSm^{-1}), low in organic carbon and available nitrogen and high in available phosphorus and potassium. The results of the study indicated that NPK and foliar spray of Zn @ 0.150 per cent through zinc metalosate (T_{13}) significantly increased the yield attributing parameters *viz*., number of bunches $plant^{-1}$ (66.73), number of berries $bunch^{-1}$ (96.44), weight of bunch (661.88 g) and yield $plant^{-1}$ (39.38 kg) compared to control. Significant improvement in total soluble solids, total sugars and decrease in titratable acidity was observed at foliar spray of zinc @ 0.150 per cent of through zinc metalosate followed by zinc @ 0.150 per cent through Zn-EDTA.

Keywords : Foliar spray, zinc metalosate, grape, yield and quality parameters

Grape (*Vitis vinifera*) is considered as one of the important commercial fruit crop and is grown in an area of about 118 ha (000 ha) with an annual production of 2483 MT (000 MT) (Anon., 2014) in India. Grape cultivation in India acquires great significance due to its high productivity as compared to many other grape producing countries. The major grape growing states in the country are Maharashtra, Karnataka, Andhra Pradesh and Tamil nadu.

The role of micronutrients in grape nutrition is well known and they are most commonly applied as foliar spray. Zinc is the important constituent of several enzymes which regulate various metabolic reactions in the plant and also essential for auxin and protein synthesis. The zinc deficiency is characterized by the abnormal development of internodes, interveinal chlorosis, small leaves, short berries and poor fruit set (Gowda *et al.,* 2008).

Material and Methods

A field experiment was conducted in order to study the effect of foliar application of zinc metalosate on yield and quality of grape in randomized block design with twenty treatments and three replications during 2015-16 at farmer's field, Marganahalli village, Chikkaballapur district, Karnataka. The treatments were T_1= control (NPK), T_2= NPK + Soil-Zn through $ZnSO_4$, T_3= NPK+FYM, T_4= NPK + foliar spray of 0.010 per cent Zn through $ZnSO_4$, T_5= NPK+ foliar spray of 0.025 per cent Zn through $ZnSO_4$, T_6= NPK+ foliar spray of 0.050 per cent Zn through $ZnSO_4$, T_7= NPK+ foliar spray of 0.100 per cent Zn through $ZnSO_4$, T_8 = NPK + foliar spray of 0.150 per cent Zn through $ZnSO_4$, T_9= NPK + foliar spray of 0.010 per cent Zn through zinc metalosate, T_{10}= NPK+ foliar spray of 0.025 per cent Zn through zinc metalosate, T_{11}= NPK + foliar spray of 0.050 per cent Zn through zinc metalosate, T_{12}= NPK + foliar spray of 0.10 per cent Zn through zinc metalosate, T_{13}= NPK + foliar spray of 0.150 per cent Zn through zinc metalosate, T_{14}= NPK + foliar spray of 0.010 per cent Zn through Zn-EDTA, T_{15}= NPK + foliar spray of 0.025 Per cent Zn through Zn-EDTA, T_{16}= NPK + foliar spray of 0.050 per cent Zn through Zn-EDTA, T_{17}= NPK + foliar spray of 0.10 per cent Zn through Zn-EDTA, T_{18}= NPK + foliar spray of 0.150 per cent Zn through Zn-EDTA, T_{19}= T_3+ Soil application of Zn through ZnSO4, T_{20}= T_3+ Foliar application of 0.01 per cent of Zn through $ZnSO_4$. Foliar spray was done thrice at vegetative stage, before flowering and at after fruit set. Zinc metalosate, zinc sulphate and Zn-EDTA are used as zinc sources. Soil

and irrigation water were analysed for various parameters. Before spray, initial plant samples (5th petiole) were collected and analysed for zinc content. At the time of harvest yield attributing parameters *viz*., number of bunches plant^{-1}, weight of bunch (g), number of berries bunch^{-1} and yield plant (kg) were recorded. After harvest of the crop the quality parameters like total soluble solids (° Brix), total sugars and titratable acidity were estimated by following standard procedures.

Results and Discussion

Initial soil properties of the experimental site indicated that soils were acid (6.45), normal in EC (0.15dSm^{-1}), low in organic carbon (0.29 per cent), low in available nitrogen (230.8 kg ha^{-1}) higher in available phosphorus (57.71 8 kg ha^{-1}) and potassium (375.2 8 kg ha^{-1}) and deficit in DTPA extractable zinc (0.54 mg kg^{-1}) (Table I).

Table I

Initial soil properties of the experimental site

Parameters	Values
pH (1:2.5)	6.45
EC (1:2.5) dS-m	0.15
SOC (%)	0.29
Available N (kg ha^{-1})	230.8
Available P_2O_5 (kg ha^{-1})	57.71
Available K_2O (kg ha^{-1})	375.2
Available S (mg kg^{-1})	18.77
DTPA-Fe (mg kg$^{-1)}$	16.94
DTPA-Mn (mg kg$^{-1)}$	17.06
DTPA-Zn(mg kg^{-1})	0.54
DTPA-Cu (mg kg$^{-1)}$	1.07
HWS-B (mg kg^{-1})	0.34

Analysis of the Irrigation water used for the experiment indicated, pH of 6.40, EC of 0.60 (dSm^{-1}) and zinc was not in detectable range (Table II).

Significantly higher number of bunches plant^{-1} were recorded in T_{13} (66.73), T_{18} (65.58) followed by T_8 (62.34) compared to all other treatments (Table III). The more number of bunches plant^{-1} were

Table II

Properties of the irrigation water used for the experiment

Parameters	Values
pH	6.40
EC(dS/m)	0.60
Ca^{2+}(meq/L)	8.00
Mg^{2+}(meq/L)	1.60
CO_3(meq/L)	Nil
HCO_3(meq/L)	2.00
Cl^-(meq/L)	4.00
Na^+(meq/L)	1.40
Zn	ND
Cu	ND
Mn	ND
Fe(ppm)	0.23
SAR	0.64
RSC	-

recorded in metalosate treatment which may be due to complete solubility of zinc metalosate in water, better penetration and availability of nutrient for plant absorption (Anon., 2000). Increased number of bunches per vine at 0.5 per cent of $ZnSO_4$ was observed in Perlette grapes (Sindhu *et al*., 2000). Foliar application of 0.05 per cent zinc through zinc sulphate significantly improved the yield attributing parameters in grapes (Aydin *et al*., 2007).

Foliar application of zinc @ 0.150 per cent through zinc metalosate, Zn-EDTA and zinc sulphate significantly improved the weight of bunches compared to control (Table IV). Girirajjat and Kacha (2015) reported that foliar spray of $ZnSO_4$ @ 0.6 Per cent to eighteen year old guava cv Bhavnagar Red at flowering and at three weeks after flowering recorded higher yield attributing characters compared to control. Foliar spray of $ZnSO_4$@ 0.4 Per cent at pea stage of fruit set increased the weight of fruit (338.33 g) compared to control (Singh *et al.,* 2015).

Among different sources and levels of zinc, zinc @ 0.150 per cent through zinc metalosate, Zn-EDTA and Zinc Sulphate along with NPK significantly

TABLE III

Effect of foliar application of zinc metalosate on yield parameters of grapes (Vitis vinifera)

Sl. No.	Treatment	No. of bunches / plant	Weight of bunch	No. of berries / bunch	Yield / plant (kg)
T_1	NPK (500: 500: 1000 kg/ha)	52.78	480.36	56.97	26.62
T_2	NPK+ Soil Zn through $ZnSO_4$	56.20	526.16	63.58	29.57
T_3	NPK + FYM @ 20 kg/plant	53.83	489.58	61.84	27.00
T_4	NPK + foliar spray of 0.010 % Zn through $ZnSO_4$	53.79	486.93	60.03	26.73
T_5	NPK + foliar spray of 0.025 % Zn through $ZnSO_4$	54.79	500.46	62.55	27.47
T_6	NPK + foliar spray of 0.050 % Zn through $ZnSO_4$	56.57	527.73	67.38	28.73
T_7	NPK + foliar spray of 0.100 % Zn through $ZnSO_4$	59.03	560.58	74.52	31.18
T_8	NPK + foliar spray of 0.150 % Zn through $ZnSO_4$	62.34	607.45	82.85	34.82
T_9	NPK + foliar spray of 0.010% Zn through Zn Metalosate	54.69	502.73	64.18	27.33
T_{10}	NPK + foliar spray of 0.025 % Zn through Zn Metalosate	56.42	520.81	68.42	28.47
T_{11}	NPK + foliar spray of 0.050 % Zn through Zn Metalosate	58.85	553.33	75.72	31.12
T_{12}	NPK + foliar spray of 0.100 % Zn through Zn Metalosate	62.27	605.54	85.75	34.78
T_{13}	NPK + foliar spray of 0.150% Zn through Zn Metalosate	66.73	661.88	96.44	39.38
T_{14}	NPK + foliar spray of 0.010 % Zn through Zn-EDTA	54.22	491.37	62.30	27.11
T_{15}	NPK + foliar spray of 0.025 % Zn through Zn-EDTA	55.47	508.20	65.58	28.19
T_{16}	NPK + foliar spray of 0.050 % Zn through Zn-EDTA	57.82	537.55	73.00	30.48
T_{17}	NPK + foliar spray of 0.100 % Zn through Zn-EDTA	61.30	586.00	81.26	33.61
T_{18}	NPK + foliar spray of 0.150 % Zn through Zn-EDTA	65.58	637.40	91.34	37.70
T_{19}	T3+ Soil application of Zn through $ZnSO_4$	57.23	529.15	68.88	30.12
T_{20}	T3+ foliar application of 0.01 % (100 ppm) of Zn through $ZnSO_4$	54.88	498.67	63.23	27.69
	SEM ±	0.77	8.84	1.90	0.82
	CD @ 5 %	2.21	25.33	5.44	2.35

improved the number of berries bunch^{-1}. Significant improvement in number of berries bunch^{-1} (42.20) in Bangalore blue grapes was observed by the foliar spray of zinc @ 0.30 per cent along with RDF (1000 g urea: 250g phosphorus: 1500 g potassium) at 30 days after pruning (Asha, 2006).

Higher grape yield were recorded in T_{13} treatment (39.38 kg plant^{-1}), T_{18} (37.70 kg plant^{-1}) and T_8 (34.82 kg plant^{-1}) treatments compared to other treatments. Increased number of bunches plant^{-1}, berries plant^{-1} and weight of bunch contributed to increase in the yield. The yield increase in zinc metalosate treatment may be the fact that the zinc metalosate is amino acid based liquid fertilizer which has got higher solubility, penetration and hence better absorption by the crop. Zn-EDTA is also more soluble in water and provides good amount of nutrients for

TABLE IV

Effect of foliar application of zinc metalosate on quality parameters of grapes (Vitis vinifera)

	Treatment	TSS (° Brix)	Total Sugars (%)	Titratable Acidity (%)
T_1	NPK (500: 500: 1000 kg/ha)	8.75	11.70	1.63
T_2	NPK+ Soil Zn through $ZnSO_4$	10.87	13.60	1.37
T_3	NPK + FYM @ 20 kg/plant	9.75	12.50	1.51
T_4	NPK + foliar spray of 0.010 % Zn through $ZnSO_4$	9.30	12.20	1.58
T_5	NPK + foliar spray of 0.025 % Zn through $ZnSO_4$	10.16	12.70	1.49
T_6	NPK + foliar spray of 0.050 % Zn through $ZnSO_4$	11.28	13.40	1.36
T_7	NPK + foliar spray of 0.100 % Zn through $ZnSO_4$	13.42	15.10	1.14
T_8	NPK + foliar spray of 0.150 % Zn through $ZnSO_4$	16.13	17.20	0.87
T_9	NPK + foliar spray of 0.010% Zn through Zn Metalosate	10.04	13.20	1.45
T_{10}	NPK + foliar spray of 0.025 % Zn through Zn Metalosate	11.23	13.90	1.30
T_{11}	NPK + foliar spray of 0.050 % Zn through Zn Metalosate	13.22	15.40	1.07
T_{12}	NPK + foliar spray of 0.100 % Zn through Zn Metalosate	15.95	17.60	0.76
T_{13}	NPK + foliar spray of 0.150% Zn through Zn Metalosate	19.13	20.30	0.39
T_{14}	NPK + foliar spray of 0.010 % Zn through Zn-EDTA	9.80	12.90	1.50
T_{15}	NPK + foliar spray of 0.025 % Zn through Zn-EDTA	10.85	13.50	1.38
T_{16}	NPK + foliar spray of 0.050 % Zn through Zn-EDTA	12.58	14.80	1.18
T_{17}	NPK + foliar spray of 0.100 % Zn through Zn-EDTA	15.10	16.60	0.89
T_{18}	NPK + foliar spray of 0.150 % Zn through Zn-EDTA	18.00	19.10	0.55
T_{19}	T3+ Soil application of Zn through $ZnSO_4$	11.87	14.00	1.27
T_{20}	T3+ foliar application of 0.01 % (100 ppm) of Zn through $ZnSO_4$	10.23	12.60	1.45
	SEM±	0.42	0.46	0.05
	CD @ 5 %	1.20	1.32	0.17

the plant absorption. Basal dose of 150: 50: 50 g NPK $vine^{-1}$ along with each time foliar addition of Zn @ 2.5 g / plant through zinc sulphate for four times at fifteen days intervals starting from before blossom significantly improved the yield (14.5 kg / grape vine) of hespali grapes of 8-10 year old in sandy soils of Turkey (Er *et al.,* 2009). Foliar application of Zn @ 0.4 per cent at enlargement of flower bud and three weeks after the flower petal drops significantly improved the yield of grapes compared to control (Bybordi *et al*., 2010). In ten year old guava *var* Gwalior-27 foliar application of zinc sulphate @ 0.4 per cent along with potassium sulphate @ 2 per cent significantly improved the yield $plant^{-1}$ (39.81 kg / plant) at Krishi Vigyan Kendra College of Agriculture, Gwalior (M.P.) (Pawar, 2016). Hamouda *et al*. (2016) reported that foliar spray of zinc @ 2000 ppm three times *viz.*, mid of March, April and June of 2011 and 2012 significantly improved the pomegranate yield $shrub^{-1}$ (12.50 and 16.16 kg / shrub) in both the seasons compared to control.

Significant improvement in total soluble solids (19.13 ºBrix), total sugars (20.30 Per cent) and decrease in titratable acidity (0.39 Per cent) were observed at T_{13} followed by T_{18} treatment. Significant

improvement in TSS (15.10Úbrix) and decrease in titratable acidity (5.13 %) was recorded by foliar spray of zinc sulphate @ 1.5 g / l in asgari variety of grapes (Ashoori *et al*., 2013). Foliar spray of zinc 0.50 per cent along with iron @ 0.50 and copper @ 0.25 per cent twice at an interval of one month (June and July, 2007-2008) on six year old kinnow mandarin increased the total soluble solids (13.25º brix), total sugars (7.24 per cent) and reduced the titratble acidity (0.70 per cent) compared to individual application and control (Kumari *et al.*, 2009). Positive response in fruit quality in terms of increase in TSS (20.75º Brix), total sugars (17.08 per cent) and decreased acidity (0.18 per cent) due to rapid conversion of metabolites into sugars and their derivatives was observed by the foliar application of $ZnSO_4$ @ 1.0 per cent in mango *cv*. (Bhowmick *et al.*, 2012).

Foliar spray of zinc @ 0.150 Per cent through zinc metalosate along with recommended dose of NPK (500: 500: 1000 kg/ha) significantly improved the yield attributing parameters *viz.*, number of bunches plant^{-1}, weight of bunch (g), number of berries bunch^{-1} and yield plant (kg plant^{-1}) and quality parameters like total soluble solids and total sugars in grapes *cv* Dilkush.

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(*Received :* May, 2017 *Accepted :* August, 2017)