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Short Communication

Response of lemon grass (Cymbopogon flexuosas) to zinc application under saline condition

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In arid and semi-arid region, soil salinity adversely affects the crop productivity. An application of zinc enhances the yield and decreases the adverse effect of soil salinity (Singh *et al.* 2012). Lemon grass (Cymbopogon flexuosus) is an important aromatic crop and has gained considerable economic importance as its essential oil is being used in the formation of different blends of perfumes, cosmetics, beverages pharmaceuticals etc. The effect of zinc on the growth and yield of lemon grass under saline condition has not been studied in detail. Hence a study was undertaken to investigate the response of zinc on lemon grass under saline condition.

A greenhouse experiment was conducted at R.B.S. College Bichpuri, Agra (U.P.) using lemon grass as test crop. The two levels each of salinity levels (Control, and 8 dSm^{-1}) and four levels of zinc (0, 1.5, 3.0 and 6.0 $mgKg^{-1}$) were evaluated in factorial randomized design with three replications. The salinity levels were created artificially by adding the calculated amounts of $CaCl_2$, $MgSO_4$, $MgCl_2$ and NaCl into the soil. After mixing the soil lots of different EC thoroughly, 10 kg soil is filled in pots. The required earthen pots of similar size and shape for experiments were selected, cleaned and lined with polythene sheet. At approximate moisture level, the soil of each pot was pulverized and three slips of lemon grass were planted in each pot. The recommended dose of N,P_2O_5 and K_2O were applied through urea single superphosphate and muriate of potash, respectively. The zinc was applied as per treatment with zinc sulphate. The crop was irrigated as and when needed. The crop was harvested after 60 days of sowing and herb and dry matter yield was recorded. These samples were wet digested with nitric and per-chloric acid. Potassium and Na were determined in the acid extract by flame photometer..Zinc content in the acid extract was determined on atomic absorption spectrophotometer. The uptake of various nutrients by plants was worked out by multiplying their content values with corresponding yield data.

Table 1: Effect of zinc on yield, quality and uptake of nutrients by lemon grass under saline condition

Treatment	Yield (g/pot)		Oil content (%)	Total content (%)	Uptake of nutrients (mg/pot)		
	Herb	Dry matter			Potassium	Sodium	Zinc
Salinity (dSm^{-1})							
Control	133.5	50.2	0.69	90.0	502	171	3.0
8	90.5	34.3	0.67	89.1	317	87	1.9
CD (P = 0.05)	5.5	1.47	NS	NS	8.9	0.70	0.25
Zinc (mg kg^{-1})							
0.0	106.0	39.5	0.66	89.5	389	159	2.1
1.5	109.5	41.9	0.68	89.6	403	162	2.3
3.0	115.5	44.3	0.69	89.7	418	165	2.5
6.0	116.4	45.2	0.69	89.8	421	163	2.6
CD (P = 0.05)	7.8	1.85	0.02	NS	12.5	2.88	0.35

A study of Table 1 reveals that the herb and dry matter yield of lemon grass decreased significantly at 8 dSm^{-1} salinity level. The reductions in herb and dry matter yields due to 8 dSm^{-1} salinity were 31.1 and 29.9 per cent, respectively. The adverse effect of soil salinity on lemon grass production is due to osmotic effect which lowers the osmotic potential of the medium, a possibility under salt stress condition. Singh *et al.* (2012) also reported similar results. Herb and dry matter yield of lemon grass increased significantly up to 6 mg Zn Kg^{-1}. The crop grown with Zn levels (1.5, 3.0 and 6.0 mg kg^{-1}) produced 4.0, 8.5 and 9.1 per cent more herb yield over control, respectively. The significant response of lemon grass to zinc application is due to low status of zinc availability in the soil. The favourable influence of Zn on yield of lemon grass was reported by Rajeswara Rao and Sukhmal Chand (1996), Singh *et al.* (2012).

A study of Table 1 reveals that the percentage of oil in lemon grass tended to decrease with EC level of 8 dSm^{-1} over control. Similar results were reported by Prasad *et al.* (1997). Application of zinc, in general, increased the oil content in lemon grass. The maximum oil percentage in plants was recorded with 6 mg Zn kg^{-1} treatment. Zinc functions in plants largely as a metal activator of enzymes like cysteine desulphydrases, dihydropeptidase, glycylglycine dipeptidase etc. Thus, addition of zinc might have activated the enzymes responsible for the production of oil, and caused higher oil content. Beneficial effects of zinc application were also reported by Rajeshwara Rao and Sukhmal Chand (1996). The soil salinity level (8.0 dSm^{-1}) did not affect the total citral content in lemon grass oil (Prasad *et al.* 2010). With increasing levels of zinc, a slight improvement in total citral content was recorded over control. The lowest value of total citral content was recorded at control treatment. Rajeshwara Rao and Sukhmal Chand (1996) also reported similar results.

A perusal of the data (Table 1) reveals that the K uptake by the crop decreased significantly with an increase in soil salinity. The reduction in K uptake may be due to an increased Na concentration in the soil solution. Similar to this study, a decrease in K uptake was also reported by Prasad *et al.* (1997). The uptake of K by lemon grass increased with the addition of Zn to the soil. There was a gradual increase in the uptake of K by lemon grass up to 3 mg Zn kg^{-1}. At 6 mg Zn kg^{-1} level a slight increase was noted over 3 mg Zn kg^{-1} level (Kumar 2019). The soil salinity (8 dSm^{-1}) increased the uptake of Na by the crop significantly over control (Prasad *et al.* 1997). Application of Zn also increased the uptake of Na by lemon grass significantly over control. The increase in Na uptake was consistent up to 3 mg Zn kg^{-1} level. The increase in Na uptake may be due to increased dry matter production with the application of Zn to the soil. A significant reduction in Zn uptake was noted with increased soil salinity over control which may be due to lower dry matter production at the higher salinity level. Increasing supply of Zn resulted in a significant increase in the uptake of Zn by lemon grass over control. The magnitude of increase in Zn uptake was significant upto the highest level of Zn application. This increase may be ascribed to greater dry matter production and improvement in zinc content in plants. Singh *et al.* (2012) also reported similar results.

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