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GROWTH RESPONSE OF "MAZENTA" (FODDER) TO N-SOURCES AND RATES IN DIFFERENT TEXTURED SALINE-SODIC SOILS

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In a pot experiment, the effects of nitrogen source and soil texture were studied on the growth of mazenta fodder under saline-sodic soil condition. An increase of 38 and 36% in fresh matter was observed through the application of ammonium sulphate over urea in sandy loam and clay loam soils, respectively. Both the nitrogen sources showed a significant increase in the fresh and dry matter yields. With the application of nitrogen fertilizers, significantly higher nitrogen but lower phosphorus, potassium, chloride and sodium concentrations in plants were observed compared to the control plants. In clay loam, 7% higher fodder yield was obtained than that in sandy loam soil.

INTRODUCTION

"Mazenta" is a new high yielding fodder crop, evolved as a hybrid by crossing maize (*Zea mays* L.) as female and "teopak" *(Zea mexicana)* as male parents. Under different soil and climatic conditions, soil salinity and sodicity, water stress, specific ion stress or toxicity and nutrient imbalance might be the possible causes for reduction in growth (Wyn Jones, 1981).

Under saline and sodic soil conditions, the N requirement for optimum yields might increase because adverse soil conditions modify the nature and extent of N transformations (Bhardwaj and Abrol, 1976). An adequate supply of nitrogen is associated with vigorous vegetative growth and a dark green colour (Tisdale *et al.,* 1985). Moreover, it produces succulence, a quality, particularly required for fodder crops.

Due to more acidifying effect as well as lower nitrogen losses (20%) from ammonium sulphate than urea, it gave significantly higher yields than the other nitrogen sources (Aggarwal *et al.,* 1986). Nitrogen efficiency showed a negative correlation with the sand percentage of soil (Vaughan *et al.,* 1990) as nitrogen losses might increase from coarse textured soils. The present investigation was, therefore, undertaken to assess the performance of "mazenta" fodder and relative efficiency of two nitrogen sources in different textured saline-sodic soils.

MATERIALS AND METHODS

The pot-culture study was conducted in the wire-house, Department of Soil Science, University of Agriculture, Faisalabad during 1989-90. Two soils, sandy loam and clay loam, were collected from Pindi Bhattian and Sadhoke areas, respectively (Table 1). Ten kilogram air-dried, sieved and thoroughly mixed soil was added in each pot. In both the soils, nitrogen was applied at rates of 0, 150 and 200 kg ha^{-1} in the form of urea as well as ammonium sulphate. Half of the nitrogen was applied at sowing and remaining half twenty days after germination. A basal dose of P_2O_5 @ 100 kg ha^{-1} was applied as single superphosphate (SSP).

Table 1. Physical and chemical characteristics of the soils

Parameter	Units	Soil 1	Soil 2
Sand	%	56	41
Silt	%	32	36
Clay	%	12	23
Texture class	-	Sandy loam	Clay loam
pHs	-	8.5	8.7
ECe	dS m^{-1}	7.0	6.5
Soluble ions:			
Ca + Mg	me L^{-1}	13.4	10.6
Sodium	"	66.3	64.0
Potassium	"	0.6	0.7
Carbonate	"	absent	2.0
Bicarbonate	"	6.2	5.3
Chloride	"	20.5	18.9
Sulphate (by difference)	49.9	49.9	49.7
SAR	-	25.6	27.8
CEC	c mol kg^{-1}	6.5	11.9
Exchangeable sodium	"	1.6	3.2
ESP	-	24.6	26.9
Total N	%	0.05	0.05
Available P	ppm	8.6	8.8
Available K	"	107.0	111.0

Canal water was applied throughout the growth period of the crop. After 60 days, crop was harvested. The data regarding germination 10 days after sowing, height of the plants 60 days after sowing and fresh as well as dry matter yields after harvesting were recorded.

Dried and ground plant samples were analysed for N, P, K, Na and Cl concentrations. Data were subjected to statistical analysis following Completely Randomized Design (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Germination: The data (Table 2) showed that the nitrogen application significantly increased the germination. On an average, 6.2 and 10% higher germination was recorded with the application of urea and ammonium sulphate over the control, respectively. Superiority of ammonium sulphate over urea might be due to its more acidifying effect which weakened the hard testa of the seeds, resulting in higher germination. Germination was higher by 8.22% in sandy loam than that in clay loam soil. In sandy loam soil, greater germination might be due to better aeration and reduced strength of the soil mass, offering less resistance to seedling emergence. These results are in conformity with those of Wolcott *et al.* (1965).

Fresh and dry matter yield: Fresh and dry matter yields increased significantly with ammonium sulphate and urea by 230 and 173%, respectively over the control (Table 2). Nitrogen application caused an increase of 38 and 36% in fresh matter yield from sandy loam and clay loam soils, respectively. Dry matter yield also increased in similar fashion by the application of nitrogen in both the soils. Ammonium sulphate gave higher fodder yield than that with urea, possibly due to reduced nitrogen losses and associated supply of sulphur to the plants through ammonium sulphate. Partially, increase in dry matter with nitrogen might be due to increased root cation exchange capacity which helped better absorption of Ca (Drake and White, 1961), an essential cation for the integrity of cell membranes (Wyn Jones and Lunt, 1967). As a result of these factors, there might be a progressive increase in biomass which caused dilution of cell sap, a good mechanism in crops to adopt and perform against salinity/sodicity. Hence, overall growth was stimulated. The results are in agreement with those of Aggarwal *et al.* (1986).

Table 2. Effect of nitrogen on growth parameters of "mazenta" fodder in saline-sodic soils.

Parameters	Nitrogen rate (kg ha^{-1})			Nitrogen source		Soil texture	
	0	150	200	Urea	Amm. sulphate	Sandy loam	Clay loam
Germination (%)	73.9 b	79.1 a	80.0 a	78.3 b	83.3 a	81.4 a	75.4 b
Height of plants (cm)	36.6 c	55.1 b	93.9 a	65.0 b	84.0 a	63.3 b	70.5 a
Fresh matter yield (g pot^{-1})	73.3 c	158.3 b	214.8 a	168.9 b	204.2 a	156.1 b	171.7 a
Dry matter yield (g pot^{-1})	14.4 c	25.5 b	30.3 a	25.4 b	30.5 a	24.1 b	26.3 a

Plant height: Plants receiving ammonium sulphate attained more height than those receiving urea (Table 2). In clay loam soil, plants were taller than those grown in sandy loam soil. Increased plant height by nitrogen application over the control might be due to improved nutrition. In clay loam soil, plants might have better nitrogen utilization than in sandy loam, as clay loam had more cation exchange capacity (Table 1). These results are in agreement with those of Ahmed *et al.* (1987).

Chemical composition of "mazenta": Nitrogen concentration of the plants showed a positive correlation with the increasing rate

Table 3. Effect of nitrogen on N, P, K, Cl and Na concentration (%) of "mazenta" fodder in saline-sodic soils

Parameters	Nitrogen rate (kg ha-1)			Nitrogen source		Soil texture	
	0	150	200	Urea	Ammonium sulphate	Sandy loam	Clay loam
Nitrogen	0.75 c	2.45 b	2.69 a	2.51 b	2.63 a	2.18 b	2.23 a
Phosphorus	0.35 a	0.26 b	0.25 b	0.24 b	0.27 a	0.27 a	0.27 a
Potassium	1.09 a	0.86 b	0.79 c	0.86 a	0.78 b	0.87 a	0.88 a
Chloride	0.41 a	0.23 c	0.27 b	0.23 a	0.21 b	0.26 a	0.26 a
Sodium	0.44 a	0.40 b	0.37 c	0.40 a	0.36 b	0.39 a	0.40 a

of nitrogen application, whereas P and K percentage decreased. In ammonium sulphate receiving plants, significantly higher N as well as P but lower K concentrations were found than the urea applied plants. Plants grown in clay loam soil had significantly higher N concentrations than those grown in sandy loam, whereas difference in P and K concentrations were statistically non-significant. Greater decrease in chloride and sodium percentages with ammonium sulphate compared with urea may possibly be due to more acidic nature of ammonium sulphate (Aslam and Muhammed, 1972) and/or mutual antagonism of sulphate and chloride ions (Tisdale *et al.*, 1985). Chloride and sodium concentrations were not statistically different in plants grown in clay loam soil than those grown in sandy loam soil.

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