Indian J. Agron. **41** (3) : 465–467 (September 1996)

Effect of gypsum application on performance of vetiver (*Veteveria zizaniodes*) grass in a highly alkali soil

ASHOK KUMAR AND R. CHHABRA

Central Soil Salinity Research Institute, Karnal, Haryana 132 001

Received: May 1993

ABSTRACT

A field experiment was undertaken during 1989–91 at Gudha Research Farm, Karnal in a barren alkali soil (initial pH, 10.5). Shoot and root yields of vetiver [*Veteveria zizanioides* (L.) Nash.] were significantly lower in the alkali plots compared with gypsum-treated plots. The analysis of major and micro-elements revealed that most of these were relatively more concentrated in the roots than in the shoots. However, K and S were greater in the shoot than in the root. In general, increasing dose of gypsum application reduced the Na concentration and enhanced that of Ca, Mg, K, P, S, Fe and Mn in the plant. Application of gypsum reduced the pH, electrical conductivity and exchangeable Na of soil and increased the exchangeable Ca + Mg in all the soil layers up to 45 cm, the effect being more pronounced in the upper 15 cm soil layer.

Vetiver [*Veteveria zizanioides* (L.) Nash.] is an important aromatic grass, because its spongy fibrous roots on steam distillation, yield an essential oil which is used in perfumery industry. Hussain (1982) reported that 'vetiver' plants grow on a variety of problem soils including water logged, saline and alkali as well as sandy soils. However, precise information on its alkali tolerance so as to indicate how much gypsum would be required if it is to be grown in highly alkali soils is not available. Hence a field experiment was conducted in a highly alkali soil to study effect of varying levels of gypsum application on yield and accumulation of major and micro-elements in 'vetiver' and on soil properties.

MATERIALS AND METHODS

A field experiment in a barren alkali soil, initial pH 10.5 and exchangeable sodium (%) 95, was started in rainy season (*kharif*) 1989 at Gudha Research Farm, Karnal (Haryana). Five levels of gypsum, viz. 0,5,10, 15 and 20 tonnes/ha representing 20, 40, 60 and 80% gypsum requirement respectively were applied on 2 August, 1989 in randomized block design with 4 replications. Two rooted slips on each hill were planted on 8 August 1989, keeping a row-to-row distance of 70 cm and plant-to-plant distance of 40 cm. A basal dose of 40 kg N/ha as urea and 5 kg Zn/ha as zinc sulphate was given to all the treatments. Plant survival was recorded periodically for 5 times during 1989 and grass was harvested on 20 February in 1991. Observation on plant height, number of tillers and leaves were recorded on 6 December 1989; and also plant height, number of tillers, number of leaves and length and width of leaves were recorded at harvesting which was done on 22 February 1991. After removing shoot portion, roots were carefully dug out with a

spade, washed with water and their weights recorded.

The plant samples for Na and K were analysed on flame photometer, phosphorus by spectrophotometer and other ions on atomic absorption spectrophotometer.

The pH and electrical conductivity of soil was measured in 1 : 2 soil; water suspension of the soil. Exchangeable Na and K in the soil were analyzed on flame photometer,

Table 1. Effect of gypsum application on the growth parameters and yield of vetiver grass

Gypsum tonnes/ha	Tillers plant at days*		Height (cm) at days* after planting		Leaves/plant at days*		Fresh weight (q/ha)	
	120	561	120	561	120	561	Shoot	Root
0	3.4	12.3	101	181	20.7	121.8	20.1	14.0
5	11.2	21.9	118	211	84.3	193.6	124.0	57.1
10	10.5	24.1	121	214	78.9	239.9	134.2	61.0
15	11.2	29.6	109	223	109.2	287.2	137.2	64.2
20	10.1	30.6	99	210	81.8	278.6	147.4	62.2
CD (P = 0.05)	3.1	4.9	NS	20	46.1	61.2	19.2	16.3

* Days after planting

Table 2. Effect of gypsum application on chemical composition of shoot and root of vetiver grass

Gypsum (tonnes/ha)	Na (mg/ 100g)	K (mg/ 100g)	Ca (mg/ 100g)	Mg (mg/ 100g)	P (mg/ 100g)	S (mg/ 100g)	Zn (ppm)	Mn (ppm)	Fe (ppm)
				Shoot					
0	149	180	133	78	44	164	20	103	550
5	127	283	143	83	48	200	20	146	562
10	83	385	143	87	51	227	19	152	575
15	76	503	145	91	56	243	19	152	563
20	56	503	148	91	55	259	19	159	563
Mean	98	370	142	86	51	219	19	142	563
CD (P = 0.05)	38	125	10	NS	NS	38	NS	21	NS
				Root					
0	246	228	195	201	48	138	24	156	4,000
5	159	335	268	258	52	167	38	166	5,000
10	154	338	315	268	52	174	37	170	5,375
15	125	348	323	265	53	190	36	157	5,625
20	84	330	320	269	54	191	35	158	5,356
Mean	154	320	284	252	52	172	36	161	5,071
CD (P = 0.05)	47	52	46	27	NS	20	NS	NS	765

whereas Ca + Mg by EDTA method (Cheng and Bray, 1951).

RESULTS AND DISCUSSION

Plant establishment was not affected significantly due to gypsum application for 38 days after transplanting and thereafter establishment (%) reduced significantly in no gypsum plots compared with gypsum-treated plots.

There was about 10% mortality in the gypsum-treated plots, whereas 65% in the control plots. This was because of high summer temperatures during April–June 1991 resulting in high evaporative demand of plants and concentration of salts in the root zone.

Application of gypsum at 5 tonnes/ha significantly increased the number of tillers and leaves over the control (Table 1). The effect of gypsum was conspicuous on the plant height only in 1991.

Shoot and root yields were significantly lower in the control than those in gypsum-treated plots (Table 1). However, the differences were non-significant among the gypsum levels.

Chemical composition

Most of the elements were more in the root than in the shoot (Table 2). However, potassium and sulphur were greater in the shoot than in the root while phosphorus was similar in both the plant parts. In general, increasing dose of gypsum reduced the Na concentration and enhanced that of Ca, Mg, K, P, S, Fe and Mn. There was a significant reduction in the shoot Na at 10 tonnes/ha gypsum, and a significant decrease in root Na was noticed at 5 tonnes/ha. Application of gypsum at 10 tonnes/ha and beyond caused a significant increase in the shoot K content, whereas in the root even 5 tonnes/ha gypsum showed significant improvement of K. Application of gypsum at 15 tonnes/ha significantly increased Ca in shoot, whereas in root it was limited to 5 tonnes/ha gypsum. Sulphur content in shoot increased significantly up to 10 tonnes/ha gypsum, whereas S in root increased significantly up to 5 tonnes/ha gypsum. There was significant increase in Mn in shoot at 5 tonnes/ha gypsum, whereas it was not affected due to gypsum application in root. Fe content in root was significantly more in 5 tonnes/ha gypsum level.

Soil improvement

Application of gypsum reduced the pH, EC, exchangeable Na and increased exchangeable Ca + Mg of soil, change being more in the upper 15 cm soil layer. Available K of the soil was not affected by gypsum application.

As the survival, growth, root and shoot yields of vetiver were not affected significantly beyond a gypsum dose of 5 tonnes/ha, thus it may be used for growing under alkali soil conditions.

REFERENCES

Cheng, K. L. and Bray, R. H. 1951. Determination of calcium and magnesium in soil and plant material. *Soil Science* **72** : 449–458.

Chhabra, R. 1985. Crop responses to phosphorus and potassium fertilization of a sodic soil. *Agronomy Journal* **77** : 699–702.

Hussain, A. 1982. A quarter century of research on essential oil seed crops in India. *Indian Perfumer* **26** (2–4) : 17–18.