SUMMARY

The field experiment was conducted in 1973 and 1974 to determine the effect of gypsum on growth and chemical composition of fodder grass species at the Central Soil Salinity Research Institute, Karnal. The experiment had five levels of gypsum (0, 3.12, 6.25, 9.37 and 12.50 t/ha) applied to each of the five fodder grass species \textit{Hybrid napier, N.B. 21 (Pennisetum purpureum} \textit{x P. typhoides), para grass (Brachiaria mitica), setaria grass (\textit{Setaria sphacelata}), guinea grass (\textit{Panicum maximum}) and anjan grass (\textit{Cynodon dactylon}). All the treatment combinations were replicated using a split plot design with gypsum levels in the main plots and grasses in the sub-plots. Anjan grass failed completely in the beginning in all the treatments and, therefore, was later replaced by bermuda grass (\textit{Cynodon dactylon}). In order to gain further information on the ESP tolerance of different grasses, experiment was conducted in pots in 1974. The soils of five ESP levels (15, 30, 45, 60 and 75) were artificially prepared by the application of sodium bicarbonate and the same five grasses as in field experiment were tried. The experiment was replicated four times.

Gypsum application increased the green and dry matter yields of all the five grasses. Green yields of the grasses significantly increased with each successive increment of gypsum up to the highest level (12.50 t/ha) except the bermuda grass in which the increase was significant up to 6.25 t/ha only. Increase in gypsum level resulted in increase of survival percentage, number of tillers per clump, plant height, number and leaf area of leaves and circumference of stem of all the grasses and these factors together resulted in the increase of fresh and dry matter yields.
of grasses. In 1973, para grass outyielded the remaining grasses. In 1974, although para grass gave the highest green fodder yield yet it was on par with bermuda grass statistically. Guinea grass produced lowest yields in both the years as much as in 1974 it did not give any yield in no gypsum plots. The green yields of grasses differed with the cuts. The cuts taken during rainy season when more favourable conditions for plant growth such as humidity warm temperature exist, gave generally the higher green yields as compared to cuts taken in either the summer or winter seasons.

Results of pot experiment show that increasing levels of ESP decreased the green yields of grasses. As in field experiment, the para grass gave highest green yields in pot experiment also, followed by bermuda grass.

When compared with the average yield in the normal soil in field where the gypsum was applied @ 6.25 t/ha and above, bermuda grass yielded as much as or even higher than in normal soil. Para grass produced about 90 per cent of the average yield as that of normal soil at 12.50 t/ha gypsum level. Thus, both the grasses (bermuda and para), can be categorised as tolerant although bermuda grass appears to be somewhat more tolerant.

Dry matter yields of the grasses increased with successive increase in the gypsum level up to 12.50 t/ha with the exception of bermuda grass where the increase in dry matter was not appreciable beyond 6.25 t/ha. In 1973, when only one cut was taken, para grass yielded maximum dry matter production followed by bermuda grass. However in 1974, bermuda grass even outyielded para grass which was essentially due to its higher dry matter percentage. On the average, the leaves of the grasses had higher dry matter percentage than the stems and complete plant. The per cent dry matter was not much affected due to gypsum levels but was very much affected by the cuts.
Application of gypsum increased the crude protein production and percentage of all the grasses. Crude protein production followed a similar trend as that of dry matter production during both the years. Bermuda grass showed the highest crude protein yield. On percentage basis (1973) the crude protein of bermuda, setaria, hybrid napier, para and guinea grasses were 10.4, 9.0, 7.3, 5.9 and 5.7 per cent respectively. The per cent crude protein was higher in the leaves than stems. Crude protein percentage was affected by the age of crop and cut. Per cent crude protein in the leaves and stems of the grasses decreased with increasing ESP levels in the pot experiment.

The ash content of the grasses studied increased with the increase in the gypsum level with highest ash content in bermuda grass, in both the years. Ash percentage of the grasses differed with the cuts.

With each increase in the gypsum level, there was increase in the concentration of Ca, Mg and P and decrease in the Na and B. The leaves of the grasses in general contained higher percentage of Ca, Mg, P and B as compared to their stems. When per cent content of the different nutrients of leaves and stems were compared to the plant, Ca and Mg possessed the intermediate position for all the grasses except guinea grass which had equal Mg percentage in the leaves and stems and less in the complete plant. Hybrid napier contained more P in complete plant, setaria and guinea grasses equal to the complete plant and para and bermuda less than the complete plant. In case of B, complete plant of hybrid napier and setaria grasses had higher B, para and bermuda grasses intermediate and guinea grass had less as compared to their leaf and stem components. Ca and Mg was more in bermuda grass and P and B in hybrid napier. Sodium and Potassium content was higher in the stems than the leaves. Higher sodium in the complete plant of hybrid napier, para and
bermuda grasses was observed when compared to leaves and stems of these grasses. Complete plant of setaria grass contained less sodium even to its leaves whereas guinea grass less than its stems but higher than the leaves. Higher sodium content was found in guinea grass followed by setaria grass. Less potassium was noticed in the complete plant of the grasses than their leaves and stems.

The results of the pot experiment were almost similar to the field experiment where with increasing level of ESP, there was significant decrease in the concentration of Ca, Mg and K and increase in Na of the grasses. However, the trend was irregular in case of P and B content of grasses in relation to ESP.

The concentration of Ca, Mg, Na, K, P and boron varied with the cuts which was either due to availability of the nutrient, season or age of the grass when that particular cut was taken.

ADF percentage of the grasses declined with the increase in the gypsum level. Hybrid napier showed the highest ADF percentage followed by guinea grass. Bermuda grass contained the lowest ADF.

Gypsum application resulted in decrease of pH, EC, ESP and B and increase in the Ca, Mg and infiltration rate of the soil both at 0 - 15 and 15 - 30 cm soil depths.

It can be concluded that the bermuda grass is the most tolerant grass to soil sodicity conditions among the grasses tried in the present investigation with para grass as the next best. Para grass had high yield potential as compared to bermuda grass. Bermuda grass was better than para grass from the point of view of dry matter production and quality. Bermuda grass contained higher percentage of crude protein, calcium, magnesium and lower fibre than para grass. Para grass responded up to highest gypsum level of 12.50 t/ha which corresponds to 50 per cent gypsum requirement and bermuda grass up to 6.25 t/ha corresponding to 25 per cent of gypsum requirement.