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Use of farmyard manure to enhance growth and yield of cowpea (*Vigna unguiculata*) under high RSC water

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ABSTRACT

A field experiment was conducted at research farm, R.B S. College, Bichpuri, Agra (U.P.) to study the effect of FYM on growth chemical composition and yield of cowpea (Vigna unguiculata L). The experiment was laid in randomized block design with four levels each of RSC of irrigation water (best water 5.0, 7.5 and 10.0 me / l) and FYM (0, 5, 10 and 15t ha^{-1}) and three replications. The results revealed that the plant height and number of leaves/plant, green foliage and dry matter yields tended to decrease with RSC levels of irrigation water. The green foliage yield decreased by 13.5, 20.6 and 26.6 per cent over control with 5, 7.5 and 10 me / ; RSC levels, respectively. The corresponding decreases in straw yield were 15.7, 26.3 and 31.5 per cent. The concentration of protein and nutrients (N, P, K, Ca and Mg) decreased significantly with RSC levels irrigation water. On the other hand, concentration of Na in cowpea plants increased significantly and maximum value was recorded with 10 me / l RSC level. Application of FYM improved growth parameters and yields of cowpea significantly over control. The protein content in cowpea plants increased from 14.25% at control to 14.62% with 15t FYM ha^{-1} application. The concentrations of all the elements significantly improved with FYM application over control.

Key words: FYM, RSC of irrigation water, yield, chemical composition, cowpea.

INTRODUCTION

Cowpea (*Vigna unguiculata* L.) is an important legume crop and it has manifold uses such as vegetable, pulse, green manuring and fodder for the live stock. Legumes play prominent role in increasing soil nitrogen level thereby boosting agricultural production. This is obliviously due to their ability to fix atmospheric gaseous nitrogen in a symbiotic association with rhizobium. Cowpea is cultivated with alkali water in semi-arid region. Besides high osmotic pressure of soil solution in the root zone, there is often an imbalance and low availability of many plant nutrients in saline environment, which is responsible for poor growth and imbalance nutrient composition of crop plants and supplemental fertilizer application has proved to overcome such effects. Application of FYM in the soil helps in increasing the fertility of the soil as well as physical condition including its water holding capacity. Farmyard manure (FYM) is valuable organic manure that can improve soil health due to its high humus, macro and micronutrient contents. Besides helping in improvement of soil structure, aeration and water holding capacity of soil, it can stimulate the microbial activity that enhances number of biological processes improving nutrient uptake. FYM also mitigates the adverse effect of high RSC irrigation water on plants and soil and increases crop production. Very meager information is available on the effect of FYM on crops under high RSC irrigation water in Agra region. Therefore, the present investigation was carried out to study the effect of FYM on performance of cowpea under high RSC irrigation water.

MATERIALS AND METHODS

A field experiment was conducted at R.B.S. College Bichpuri, Agra (U.P.). The soil was sandy loam in texture having pH 8.2, organic carbon 2.4 g kg^{-1}, available N 158 kg ha^{-1}, available P 9.5 kg ha^{-1}, and available K 112 kg ha^{-1}. The experiment was conducted in randomized block design with three replications. Treatments consisted four levels each of RSC of irrigation water (best water, 5, 7.5 and 10 me / l) and FYM (0, 5, 10 and 15t ha^{-1}). FYM was applied at the time of sowing. The basal dose of nitrogen, phosphorus and potassium at the rate of 20, 60 and 40 kg ha^{-1} were applied through diammonium phosphate and muriate of potash, respectively at the time of sowing. The RSC waters were prepared by dissolving sodium bi carbonate in canal water (EC 0.4 dSm^{-1}). The seeds of cowpea were sown at optimum moisture. The crop was irrigated with canal

water after 10-15 days of sowing and thereafter irrigations with treatment water were applied. The crop was allowed to grow up to three months. The growth parameters (plant height and number of leaves / plant) were recorded at harvest. At harvest green foliage yield was recorded. The plants were oven dried at 70^{o} C and dry matter yield was recorded. The plant samples were analysed for their N, P, K, Ca, Mg and Na contents by adopting standard procedures (Jackson 1973).

RESULTS AND DICUSSION

Growth characters

The data (Table 1) revealed that the high RSC irrigation water reduced significantly the plant height and number of leaves/plant over control. The minimum values of plant height (34.6 cm) and number of leaves/plant (13.6) were recorded at RSC level of 10 me/l. This may be attributed to adverse effect of RSC on plant nutrition and physical condition of soil. Singh *et al.* (2005) also reported similar results. On the other hand, plant height and number of leaves/plant increased significantly with increasing FYM levels over control. This increase in these attributes may be attributed to increased availability of nutrients due to mineralization of FYM during the process of decomposition. Singh *et al.* (2016) also reported an increase in growth characters of cluster bean with FYM application.

Table 1: Growth characters, yield and quality of cowpea as affected by RSC of Irrigation water and FYM

Treatment	Plant height (cm)	Leaves/Plant	Yield (kg/plot)		Protein (%)
			Green foliage	Dry matter	
RSC (me/l)					
Control	40.8	17.8	23.7	0.38	15.25
5.0	38.4	15.8	20.5	0.32	14.94
7.5	36.8	14.3	18.8	0.28	14.25
10.0	34.6	13.6	17.4	0.26	13.37
CD (P=0.05)	2.17	1.21	0.21	0.03	0.19
FYM (%)					
Control	36.0	13.5	17.7	0.29	14.25
0.5	37.5	14.8	19.0	0.31	14.37
1.0	38.7	16.0	20.1	0.33	14.50
1.5	40.0	17.2	23.7	0.36	14.62
CD (P=0.05)	2.17	1.21	0.21	0.03	0.19

Yield

The RSC levels of irrigation water tended to decrease significantly the green foliage and dry matter yield of cowpea crop over control. The mean reduction in green foliage yield with RSC levels of 5, 7.5 and 10 me/l over control were 13.5, 20.6 and 26.6 per cent, respectively. The corresponding reductions in dry matter yield were 15.7, 26.3 and 31.5 per cent. Similar results were reported by Uma and Agrawal (2005 a). The green foliage and dry matter yield of cowpea increased significantly with each level of FYM as compared to control. The higher level of FYM (15t ha^{-1}) proved superior over other FYM levels in respect of green foliage and dry matter production. This increase in yield of cowpea due to FYM application may be attributed to increased availability of nutrients to plants. Similar results in cluster bean were reported by Singh *et al.* (2016).

Quality

Protein content in cowpea plants decreased significantly with RSC levels of irrigation water over control and minimum value (13.37%) was recorded with 10 me/l RSC level (Kumar *et al.* 2006) There was significantly higher percentage of protein in cowpea plants under all the levels of FYM as compared to control. From quality point of view, application of 15t FYM ha^{-1} appeared to be the best. The minimum protein content in cowpea plants was recorded with no FYM

treatment. This improvement in protein content may be attributed to increased nitrogen content in cowpea plants with the application of FYM. Similar increase in protein content in forage cluster bean with FYM application was also reported by Singh *et al.* (2016).

Table 2: Concentration of nutrients (%) in cowpea plants as affected by RSC and FYM

Treatment	Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sodium
RSC (me/l)						
Control	2.44	0.75	1.57	0.47	0.31	0.16
5.0	2.39	0.70	1.54	0.45	0.29	0.18
7.5	2.28	0.66	1.50	0.41	0.26	0.21
10.0	2.24	0.62	1.46	0.37	0.22	0.24
CD (P=0.05)	0.07	0.03	0.04	0.02	0.03	0.01
FYM (%)						
Control	2.28	0.66	1.51	0.39	0.25	0.17
0.5	2.30	0.68	1.53	0.42	0.26	0.19
1.0	2.34	0.69	1.56	0.44	0.27	0.21
1.5	2.38	0.72	1.57	0.45	0.29	0.23
CD (P=0.05)	0.07	0.03	0.04	0.02	0.03	0.01

Chemical composition of plants

It is evident (Table 2) that the RSC levels of irrigation water have an adverse effect on nitrogen content in plants of cowpea. For each increase in RSC of water there was a significant decrease in the N content in plants (Kumar *et al.* 2006). Application of FYM had significantly beneficial effect on N content in plants over control and maximum value was noted with 15t FYM ha^{-1} addition. This increase in N content may be attributed to increased N availability in soil solution due to FYM application (Singh *et al.* 2016). Phosphorus content in plants decreased with RSC levels and adverse effect was more pronounced at higher RSC level. Similar adverse effect of sodic water was reported by Uma and Agrawal (2005 b). Phosphorus content in plants increased significantly with the application of FYM which may be attributed to increased availability of native and applied phosphorus due to liberation of organic acids during decomposition of FYM. Similar results were reported by Singh *et al.* (2016).

Potassium content in cowpea plants decreased significantly with RSC levels of water. On the other hand potassium content improved markedly with the application of FYM. Potassium content in plants increased from 1.51% at control to 1.57% with 15t FYM ha^{-1} (Singh *et al.* 2016). The content of calcium and magnesium reduced significantly with increasing levels of RSC of water and minimum values were recorded with 10.0 me/l RSC level indicating an adverse effect of RSC on availability of calcium and magnesium (Kumar *et al.* 2006). Addition of FYM significantly increased the concentration of calcium and magnesium in cowpea plants over control. Similar results were reported in broad bean by Manorama and Uma (2006). Sodium content in cowpea plants enhanced significantly with increasing levels of RSC in irrigation water. Similar results were reported by Kumar *et al.* (2006). The maximum value of Na (0.24%) content was recorded with 10 me/l RSC level. Application of FYM also increased the sodium content in cowpea plants over control.

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