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# Effect of FYM on yield and uptake of nutrients in wheat (*Triticum aestivum*) with high RSC water

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## ABSTRACT

*A field experiment was conducted at R. B. S. College research farm Bichpuri, Agra (U.P.) to study the effect of FYM on growth yield and uptake of nutrients by wheat (Triticum aestivum). The experiment was laid out 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 tillers/plant, grain and straw yields tended to decrease with RSC levels of irrigation water. The grain yield decreased by 6.7, 10.0 and 27.2 per cent over control with 5, 7.5 and 10 me / l RSC levels, respectively. The corresponding decreases in straw yield were 7.1, 15.8 and 28.3 per cent. The content and yield of protein decreased significantly with RSC levels irrigation water. The uptake of N, P and K was adversely affected by RSC levels of irrigation water over control (best water). On the other hand, uptake of Na in wheat grain and straw increased significantly and maximum value was recorded with 10 me / l RSC level. Application of FYM improved growth parameters and yields of wheat significantly over control. The protein content in wheat grain increased from 11.9% at control to 12.9% with 15t FYM ha$^{-1}$. The uptake of all the elements significantly improved with FYM application over control.*

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

## INTRODUCTION

Wheat (*Triticum* aestivum) is one of the most important cereal crop because it is the staple food of the people of India. In India, the productivity of wheat with high RSC water very low due to accumulation of salts. Wheat 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 yield of the crops. The 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 (Kumar *et al.* 2006). 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 wheat under high RSC irrigation water.

## MATERIALS AND METHODS

A field experiment was conducted at research farm, 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$^{-1}$, 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 wheat were sown at the rate of 100 kg ha$^{-1}$. The crop was irrigated with canal water after 20-25 days of sowing and there after irrigations with treatment water was applied. The crop was allowed to grow up to

maturity. The growth parameters (plant height and number of tillers/ plant) were recorded at harvest. At harvest green grain and straw yield was recorded. Grain and straw were analysed for their N, P, K, Ca, Mg and Na contents by adopting standard procedures (Jackson 1973). The uptake of nutrients was calculated by multiplying the concentration values with the respective grain and straw yield.

## RESULTS AND DICUSSION

### Growth characters

The data (Table 1) revealed that the high RSC irrigation water reduced significantly the plant height and number of tillers/plant over control. The minimum values of plant height (76.7 cm) and number of tillers/plant (4.1) 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. Kumar et al, (2006) also reported similar results. On the other hand, plant height and number of tillers/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 and Singh (2017) also reported an increase in growth characters of cluster bean with FYM application.

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

| Treatment | Plant height (cm) | Tillers/ Plant | Yield (t ha$^{-1}$) | | Protein (%) | | Protein yield ( kg ha$^{-1}$) |
|---|---|---|---|---|---|---|---|
| | | | Grain | Straw | Grain | Straw | |
| RSC (me/l) | | | | | | | |
| Control | 86.8 | 5.6 | 4.16 | 4.80 | 13.1 | 3.5 | 545.0 |
| 5.0 | 84.4 | 5.2 | 3.88 | 4.46 | 12.6 | 3.3 | 488.8 |
| 7.5 | 80.6 | 4.6 | 3.47 | 4.04 | 12.1 | 3.1 | 420.0 |
| 10.0 | 76.7 | 4.1 | 3.03 | 3.44 | 11.8 | 2.9 | 357.4 |
| CD (P=0.05) | 2.25 | 0.40 | 0.80 | 0.84 | 0.26 | 0.15 | 21.2 |
| FYM (%) | | | | | | | |
| Control | 80.0 | 4.0 | 3.14 | 4.02 | 11.9 | 3.1 | 345.4 |
| 0.5 | 82.0 | 4.6 | 3.74 | 4.39 | 12.2 | 3.2 | 456.2 |
| 1.0 | 83.7 | 5.0 | 3.97 | 4.40 | 12.6 | 3.3 | 500.2 |
| 1.5 | 84.3 | 5.7 | 4.07 | 4.62 | 12.9 | 3.4 | 525.0 |
| CD (P=0.05) | 2.25 | 0.40 | 0.80 | 0.84 | 0.26 | 0.15 | 21.2 |

### Yield

The RSC levels of irrigation water tended to decrease significantly the grain and straw yield of wheat crop over control. The mean reduction in grain 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 straw yield were 15.7, 26.3 and 31.5 per cent. Similar results were reported by Singh and Yadav (2007). The grain and straw yield of wheat 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 grain and straw production. This increase in yield of wheat due to FYM application may be attributed to increased availability of nutrients to plants. Similar results in wheat were reported by Singh and Patra (2017).

### Quality

Protein content in wheat grain and straw decreased significantly with RSC levels of irrigation water over control and minimum values (11.8 and 2.9%) were recorded with 10 me/l RSC level (Kumar *et al.* 2006) There was significantly higher percentage of protein in wheat grain and straw 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 wheat grain and straw was recorded with no FYM treatment. This improvement in protein content may be attributed to increased nitrogen content in wheat crop with the application of FYM. Similar increase in protein content in wheat with FYM application was also reported by Singh and Patra (2017). Protein yield of wheat grain decreased with increasing levels of RSC of

irrigation water and minimum value (357.4 kg ha$^{-1}$) was recorded with 10 me/l RSC. This reduction in protein yield may be attributed to reduction in grain yield (Yaduwanshi and Sharma 2007). Protein content in wheat increased from 345.4 kg ha$^{-1}$ at control to 525.0 kg ha$^{-1}$ with 15t FYM ha$^{-1}$, This increase in protein yield may be attributed to increased grain yield and N content in grain. Similar results were reported by Singh and Patra (2017) and Kumar *et al.* (2015).

Table 2: Effect of RSC and FYM on uptake of nutrients (kg ha$^{-1}$) by wheat

| Treatment | Nitrogen | | Phosphorus | | Potassium | | Sodium | |
|---|---|---|---|---|---|---|---|---|
| | Grain | Straw | Grain | Straw | Grain | Straw | Grain | Straw |
| RSC (me/l) | | | | | | | | |
| Control | 87.4 | 26.8 | 11.6 | 5.7 | 19.9 | 86.8 | 4.1 | 48.4 |
| 5.0 | 78.3 | 23.6 | 10.8 | 4.5 | 17.0 | 78.9 | 4.0 | 46.8 |
| 7.5 | 67.6 | 20.2 | 8.3 | 3.6 | 14.5 | 69.4 | 5.2 | 44.4 |
| 10.0 | 56.3 | 15.8 | 6.3 | 2.7 | 12.1 | 58.1 | 5.4 | 51.7 |
| CD (P=0.05) | 6.80 | 2.41 | 1.11 | 0.68 | 2.04 | 3.96 | 0.47 | 1.18 |
| FYM (ha$^{-1}$) | | | | | | | | |
| Control | 59.6 | 20.5 | 6.5 | 3.2 | 12.5 | 70.6 | 4.7 | 45.8 |
| 0.5 | 73.3 | 21.5 | 9.0 | 3.6 | 15.7 | 75.9 | 5.2 | 43.9 |
| 1.0 | 79.7 | 23.3 | 10.7 | 4.8 | 17.4 | 77.8 | 5.1 | 46.2 |
| 1.5 | 93.8 | 25.4 | 11.4 | 5.5 | 19.1 | 83.1 | 4.4 | 46.2 |
| CD (P=0.05) | 6.80 | 2.41 | 1.11 | 0.68 | 2.04 | 3.96 | 0.47 | 1.18 |

**Uptake of nutrients**

Nitrogen uptake by wheat grain and straw decreased with increasing levels of RSC of irrigation water over control (best water). The wheat grown with RSC levels of irrigation water utilized lower amounts of nitrogen than those grown with best water. Thus the minimum uptake of nitrogen by wheat grain (56.3 kg ha$^{-1}$) and straw (15.8 kg ha$^{-1}$) was recorded with me/l RSC level (Kumar *et al.* 2006). Application of FYM increased the nitrogen uptake by wheat crop significantly over the control. All the levels of FYM proved significantly superior over control in respect of nitrogen uptake by wheat crop. The maximum values of N uptake by wheat grain and straw were recorded at 15t FYM ha$^{-1}$ (Singh and Patra 2017). The maximum utilization of phosphorus by wheat grain and straw was noted with best water irrigation. Thereafter reduction in P uptake was noted at all the levels of irrigation water and minimum values were recorded with 10 me/l RSC. This decrease may be attributed to reduction in yield and P content. Similar results were reported by Yaduwanshi and Sharma (2007). The uptake of phosphorus by wheat crop increased significantly with FYM application. The maximum values of P uptake by wheat grain (11.4 kg ha$^{-1}$) and straw (5.5 kg ha$^{-1}$) were recorded with 15t FYM ha$^{-1}$. This increase in P uptake may be attributed to increased yield of wheat (Singh and Singh 2017). The uptake of potassium by wheat grain and straw decreased significantly with RSC levels over best water irrigation. The minimum of K uptake by wheat grain (12.1 kg ha$^{-1}$) and straw (58.1 kg ha$^{-1}$) were recorded with 10 me/l RSC levels, which may be attributed to lower yield of wheat with RSC levels (Singh and Yadav 2007). FYM application had significant beneficial effect on the utilization of potassium by wheat grain and straw over control. The increase in K uptake by wheat grain due to 5. 10 and 15t FYM ha$^{-1}$levels over control 2.1, 4.9 and 6.6 kg ha$^{-1}$, respectively. This increase in the utilization of K by wheat crop with FYM application is obvious as it is considered as a store house of plant nutrients (Kumar *et al.* 2015). The sodium uptake by wheat grain and straw significantly with higher (10me/l) levels of RSC of irrigation water over best water irrigation. Similar results were reported by Yadav and Chhipa (2005) and Yaduwanshi and Sharma (2007). Application of FYK tended to increase the uptake of sodium by wheat crop over control. Yaduwanshi and Sharma (2007) and Yadav and Chhipa (2005) also reported similar results.

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