# Influence of Integrated Nutrient Management on Uptake and Soil Nutrients Status in Sorghum- Wheat Crop Sequence

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## Abstract

A long term experiment on sorghum- wheat crop sequence under integrated nutrient management was carried out at Integrated Farming System Research Project Farm, Dr. PDKV,Akola(MS) during 2011-12 with an object to study the effect of INM treatments on nutrient uptake by sorghum and nutrient status in soil after 28 th years crop cycle.

Results indicated that significantly highest nitrogen uptake by sorghum was noted in treatment T3. In case of phosphorous and potassium, the maximum uptake of these nutrients in sorghum was recorded by treatment T5. While,Treatment T6 recorded significantly maximum values for available NPK and organic carbon content in soil. No much change was observed in soil pH and EC after 28th years of experimentation.

**Keywords:** Productivity, profitability, INM, RDF, FYM, SEY, Monetary returns etc.

**Introduction**

Sorghum- wheat sequence is a popular double cropping system under irrigated condition in semi arid tract of Vidarbha region of Maharashtra. This cereal- cereal based crop sequence is fairly exhaustive but giving 3.1 to 3.7 t/ha grain yield of sorghum and 2.0 to 2.3 t/ha of wheat. Long term studies being carried out at several location in various cropping system throughout the country indicates that the application of all essential nutrients through chemical fertilizers alone has bad effect on response of sorghum and wheat crops individually.However, limited information is available on INM in cereal – cereal based sorghum-wheat crop sequence. It has been realized that system based optimum use of different plant nutrient supply sources of organic, inorganic and in combination which will be more affordable, sustainable and remunerable for getting higher monetary return with fertilizer economy and better soil health with an object to identify the sustainable INSS for sorghum- wheat crop sequence in Vidarbha. Keeping this fact in view, the present investigation was undertaken to study the effect of chemical fertilizers alone and in combination with organics on nutrient uptake and nutrient content of soil in sorghum-wheat crop sequence.

**Materials and Methods**

A field trial was conducted during 2011-12 at AICRP on IFSR Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS). The experimental site was leveled and uniform, medium black cotton soil of an order inceptisol with carbon content of 0.40 %, available NPK (209,11, 350 kg $ha^{-1}$), $p^H$ 7.4 and EC 0.20 $dSm^{-1}$.

The experiment was laid out in RBD and replicated four times with 12 treatment combination indicating treatment $T_1$ and $T_{12}$ were control and farmers practice, treatments $T_2$ to $T_5$ were of reduced RDF and treatments $T_6$ to $T_{11}$ with INM used for *kharif* sorghum and wheat with 100, 75 & 50 % RDF alone. To fulfill the required dose of nutrient N to sorghum was made available through different organic sources viz., FYM, wheat straw and leucana loppings. Sorghum hybrid CSH-14 and wheat variety AKW-3722 were used for sowing along with University recommended package of practice for field operations. All organic and chemical fertilizers were applied treatment wise to individual plots before and at sowing except leucana loppings incorporation after inter-cultivation in sorghum. The treatment details are given below.

| Treat | Kharif sorghum | Rabi wheat |
|---|---|---|
| $T_1$ | Control | Control |
| $T_2$ | 50 % RDF through fertilizers | 50%RDF through fertilizers |
| $T_3$ | 50% RDF through fertilizers | 100% RDF through fertilizers |
| $T_4$ | 75% RDF through fertilizers | 75% RDF through fertilizers |
| $T_5$ | 100% RDF through fertilizers | 100% RDF through fertilizers |
| $T_6$ | 50 % RDF through fertilizers + 50% N through FYM | 100% RDF through fertilizers |
| $T_7$ | 75 % RDF through fertilizers +25% N through FYM | 75% RDF through fertilizers |
| $T_8$ | 50 % RDF through fertilizers +50% N through wheat straw | 100% RDF through fertilizers |
| $T_9$ | 75 % RDF through fertilizers +25% N through wheat straw | 75% RDF through fertilizers |
| $T_{10}$ | 50%RDFthroughfertilizers +50% N through leucana loppings | 100% RDF through fertilizers |
| $T_{11}$ | 75%RDFthrough fertilizers +25% N through leucana loppings | 75% RDF through fertilizers |
| $T_{12}$ | Farmers practice (50:20:00 kg NPK $ha^{-1}$ ) | Farmerspractice(40:20:12.5kgNPK $ha^{-1}$ ) |
| **RDF** | 120 :60 :60 kg NPK $ha^{-1}$ | 120 :60 :60 kg NPK $ha^{-1}$ |

**Results and Discussion**

**Uptake of Nutrients by Sorghum**

Data presented in Table 1 indicated that significantly highest nitrogen uptake (116.98 kg $ha^{-1}$) by sorghum was recorded in the treatment of 50% NPK through fertilizers which was nearly followed by 100% RDF to sorghum and found at par with treatments $T_7$,$T_6$, $T_9$, $T_{11}$, $T_{10}$, $T_4$, $T_8$, $T_{12}$ and superior over rests. Significantly highest phosphorous uptake (31.36 kg $ha^{-1}$) was noted in treatment 100% RDF to sorghum which was at par with $T_7$ and superior over rest of treatments. Second best position in recording significantly highest phosphorous uptake was registered by treatment $T_6$ and it was at par with $T_{11}$, $T_{10}$ and $T_9$. Treatment $T_8$ recorded significantly maximum phosphorous uptake and found at par with $T_{12}$, $T_3$ and $T_4$. Significantly superior uptake of potassium was noticed with treatment of 100% RDF to sorghum than rests. Treatment $T_7$ being par with $T_6$ recorded significantly highest potassium uptake and got second best position. Whereas, treatment $T_{11}$ being par with $T_9$, $T_{10}$, $T_4$ recorded significantly maximum potassium uptake over remaining treatments. Treatment $T_{12}$ being par with $T_8$ and $T_3$ but significantly greater over other treatments. While, lowest NPK uptake was noticed in control. The maximum uptake of NPK was recorded when rainy season crops and succeeding wheat received 100% and 75 % RDF. This could be attributed to the fact that added fertilizers enhanced the availability of these nutrients to plant. This might have resulted in profused shoot and root growth and thereby activating greater absorption of these nutrients from soil and improved grain and stalk/straw yields. These findings are in close conformity with those of Sharma, (1990) and Shivran, (1998).

**Soil Nutrient Status after Harvest of Sorghum and Wheat**

Results indicated that (Table 1) significantly higher available NPK and organic carbon content (319, 34, 445 kg $ha^{-1}$ and 0.60 %) were recorded by treatment $T_6$ over rest of the treatments. Treatment $T_8$ being par with $T_7$, $T_5$, $T_{10}$, $T_{11}$ and $T_4$ recorded significantly second best position in recording higher nitrogen content. Treatment $T_9$ being par with $T_3$ recorded maximum nitrogen content.While, treatment $T_2$ being par with $T_{12}$ recorded more nitrogen. In case of phosphorous content, treatment $T_8$ being par with $T_7$ and $T_5$ recorded maximum P content in soil. Treatment $T_2$ and $T_{12}$ at par with each other recorded higher P content in soil. As for as potassium concerned, treatment $T_7$ being par with $T_5$, $T_4$ and $T_{10}$ recorded greater K content in soil. Treatment $T_{11}$ being par with $T_3$ recorded highest K content. Whereas, treatment $T_2$ and $T_{12}$ being par with one another gave significantly maximum K content in soil. Treatment $T_{10}$ being par with $T_{11}$, $T_9$, $T_4$ and $T_3$ recorded significantly more content of organic carbon than others. Increase in NPK and organic carbon content in soil might be due to direct addition of these nutrients through mineralization of organic matter and decomposition carried out by microorganisms, in addition presence of higher population of beneficial microbes like N-fixers, P-solubilizers and VAM fungi and increased enzymatic activity might have favoured the availability of these nutrients in soil. Similar results were also reported by Kale et al., (1992).

**Organic carbon content, $p^H$ and EC of soil**

Treatment $T_6$ nearly followed by $T_7$ recorded significantly highest organic carbon content (0.60, 0.66 % and 0.56, 0.60 %) than other treatments. Treatment $T_{10}$, $T_8$, $T_9$ and $T_5$ recorded similar organic carbon content of 0.52, 0.65-0.59% but found superior over rests. Treatment $T_{11}$ recorded significantly maximum organic carbon content than other treatments. Treatments of $T_{12}$, $T_3$ and $T_2$ also recorded more content of organic carbon and lowest in $T_1$. Increased organic carbon content of soil might be due to addition of nutrients through mineralization and decomposition of organic matters carried out by microbes (Kale et al., 1992). But no much change was occurred in soil $p^H$ and EC. Whereas, application of FYM reduced soil $p^H$, it might be due to release of organic acids during decomposition of added organic matter and increased microbial and enzymatic activity in soil (Venkatesh,1995). While, 100% RDF ($T_5$) treatment recorded maximum 0.33 $dSm^1$ EC and all INM treatments showed minute reduction in EC. Similar trend of observation was also found in soil analysis after harvest of *rabi* season wheat (Table1).

**References**

1. Kale, R. D., B. C. Mallesh, K. Bano and D. J. Bagyaraj (1992). Influence of Vermi-compost application on available macronutrients and selected microbial population in paddy field. Soil Biol. Biochem. 24: 1317-1320.
2. Sharma, K. N., A. L. Bhandari, D. S. Rana, M. L. Kapur and J. S. Sodhi (1990). Crop yield, nutrient uptake and soil properties as influenced by components of crop technology in pigeonpea-wheat crop sequence. J. of Indian Soc. Soil Sci. 38 (3):5208.

3. Shivran, P. L. (1998). Studies on phosphorous and sulphur fertilization in pigeonpea and their residual effect on succeeding wheat. Ph. D. Thesis, IARI, N.Delhi.

4. Venkatesh, K. (1995). Effect of vermin-culture on soil composition, growth, yield and quality of Thompson seedless grapes. M.Sc. (Agri.) Thesis, UAS, Dharwad, Karnatka.

**Table 1.**
**Nutrient Uptake And Nutrient Content of Soil as Influenced by Different Treatments in Sorghum-Wheat Crop Sequence During 2011-12.**

| Treatments | Nutrient uptake by sorghum (kg ha$^{-1}$) | | | Nutrient status after harvest of kharif sorghum (kg ha$^{-1}$) | | | OC% | pH | EC (dSm$^2$) | Nutrient status after harvest of rabi wheat (kg ha$^{-1}$) | | | OC% | pH | EC (dSm$^2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | P | K | N | P | K | | | | N | P | K | | | |
| $T_1$ | 15.25 | 4.42 | 20.64 | 95.00 | 7.61 | 173.00 | 0.16 | 8.09 | 0.31 | 113.00 | 9.17 | 253.00 | 0.36 | 8.23 | 0.38 |
| $T_2$ | 51.65 | 14.03 | 53.50 | 185.00 | 14.72 | 235.00 | 0.39 | 8.05 | 0.26 | 215.00 | 19.13 | 199.00 | 0.50 | 8.31 | 0.34 |
| $T_3$ | 116.98 | 16.08 | 61.53 | 211.00 | 15.09 | 274.00 | 0.44 | 7.99 | 0.31 | 224.00 | 22.36 | 190.00 | 0.51 | 8.13 | 0.30 |
| $T_4$ | 72.61 | 15.07 | 80.40 | 229.00 | 17.07 | 323.00 | 0.47 | 8.04 | 0.32 | 236.00 | 22.59 | 211.00 | 0.54 | 8.15 | 0.36 |
| $T_5$ | 110.15 | 31.36 | 142.07 | 249.00 | 27.65 | 360.00 | 0.52 | 7.99 | 0.33 | 309.00 | 30.02 | 282.00 | 0.63 | 8.21 | 0.37 |
| $T_6$ | 87.11 | 24.54 | 102.43 | 319.00 | 33.99 | 445.00 | 0.60 | 8.03 | 0.30 | 325.00 | 32.90 | 313.00 | 0.66 | 8.06 | 0.47 |
| $T_7$ | 97.28 | 27.66 | 114.08 | 253.00 | 24.75 | 361.00 | 0.56 | 8.04 | 0.28 | 305.00 | 27.25 | 202.00 | 0.60 | 8.02 | 0.41 |
| $T_8$ | 68.16 | 18.32 | 76.66 | 253.00 | 21.42 | 340.00 | 0.52 | 8.11 | 0.26 | 310.00 | 29.16 | 279.00 | 0.62 | 8.15 | 0.35 |
| $T_9$ | 81.83 | 22.89 | 94.81 | 228.00 | 17.80 | 243.00 | 0.52 | 8.07 | 0.27 | 293.00 | 25.37 | 266.00 | 0.59 | 8.19 | 0.31 |
| $T_{10}$ | 79.34 | 22.93 | 93.76 | 234.00 | 18.62 | 300.00 | 0.53 | 8.04 | 0.27 | 312.00 | 27.23 | 192.00 | 0.65 | 8.06 | 0.34 |
| $T_{11}$ | 81.46 | 23.23 | 97.14 | 230.00 | 18.27 | 292.00 | 0.49 | 8.06 | 0.29 | 306.00 | 26.78 | 158.00 | 0.60 | 8.03 | 0.34 |
| $T_{12}$ | 67.83 | 16.40 | 78.18 | 161.00 | 13.40 | 212.00 | 0.36 | 8.09 | 0.29 | 205.00 | 15.52 | 205.00 | 0.47 | 8.14 | 0.34 |
| **SEm ±** | 17.91 | 1.33 | 5.99 | 8.57 | 1.12 | 14.97 | 0.007 | 3.83 | 1.85 | 1.76 | 0.32 | 1.64 | 0.01 | 0.01 | 0.09 |
| **CD@ 5%** | 50.31 | 3.76 | 16.83 | 24.08 | 3.14 | 42.07 | 0.002 | 0.10 | 5.21 | 4.94 | 0.91 | 4.62 | 0.03 | 0.03 | 0.02 |