International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(1): 1095-1097

Received: 04-11-2017
Accepted: 05-12-2017

**JB Patil**
Department of Agronomy,
N. M. College of Agriculture,
Navsari Agriculture University,
Navsari, Gujarat, India

**MK Arvadia**
Department of Agronomy,
N. M. College of Agriculture,
Navsari Agriculture University,
Navsari, Gujarat, India

**DS Thorave**
Department of Agronomy,
N. M. College of Agriculture,
Navsari Agriculture University,
Navsari, Gujarat, India

**Correspondence**
**JB Patil**
Department of Agronomy,
N. M. College of Agriculture,
Navsari Agriculture University,
Navsari, Gujarat, India

# Effect of integrated nitrogen management on nutrient content, uptake, quality and yield of *rabi* sorghum (*Sorghum bicolour* L.) under South Gujarat condition

**JB Patil, MK Arvadia and DS Thorave**

**Abstract**
A field experiment was conducted at the College Farm, Navsari Agricultural University, Navsari (Gujarat) during the year 2015-16 and 2016-17 on clayey soil to study the effect of INM on growth, yield and economics of *rabi* sorghum. The treatment consisted of integrated nitrogen management *viz*., 100% RDF (80:40:0 NPK/ha) through inorganic fertilizer + biocompost @ 10 t/ha ($T_1$), 100% RDN through inorganic fertilizer ($T_2$), 75% RDN through inorganic fertilizer + 25% RDN through biocompost ($T_3$), 75% RDN through inorganic fertilizer + 25% RDN through biocompost + biofertilizer ($T_4$), 50% RDN through inorganic fertilizer + 50% RDN through biocompost ($T_5$) and 50% RDN through inorganic fertilizer + 50% RDN through biocompost + biofertilizer ($T_6$) replicated four times in randomized block design. Result revealed that 100% RDF (80:40:0 NPK/ha) through inorganic fertilizer + biocompost @ 10 t/ha recorded numerically higher nutrient NPK content in grain and stover as well as protein content in grain of sorghum. Treatment 100% RDF (80:40:0 NPK/ha) through inorganic fertilizer + biocompost @ 10 t/ha registered significantly higher total uptake of nutrient NPK by sorghum crop and protein yield over rest of treatment.

**Key wards:** Yield, Nutrient content, uptake, Economics and protein yield

## Introduction
Sorghum (*Sorghum bicolor* L.) is a unique drought resistant crop among the major cereals and the fifth most important cereal in the world after wheat, rice, maize and barley. Due to heavy rains and winds during *kharif* season losses are observed in agricultural crops. So, *rabi* sorghum may be an option for the *kharif* sorghum in such areas. *Rabi* sorghum may help to reduce the production gap caused due to replaced *kharif* sorghum in sorghum producing states viz., Maharashtra, Gujarat, Karnataka and Andhra Pradesh.
The appropriate combination of mineral fertilizers and organic manures for higher productivity varies according to the system, land use, ecological, social and economic conditions. Experiences from long term fertilizer experiments revealed that integrated use of farm yard manures, vermicompost, biocompost, *etc.* with graded levels of chemical fertilizers is promising not only in maintaining higher productivity but also improves the nutrient content, uptake and protein yield (Patel, 2015). Also, among several bio-agents, *Azospirillum* alone and in combination with PSB increases the yield of sorghum (Patidar and Mali, 2004). Relatively little is known about the response of *rabi* sorghum to INM with biocompost and biofertilizers. Hence, the said study was undertaken at NAU, Navsari (Gujarat).

## Materials and methods
A field experiment was conducted at the College Farm, Navsari Agricultural University, Navsari during the year 2015-16 and 2016-17. The soil of the experimental field was clayey in texture, low in organic carbon (0.39%) and available nitrogen (204.50 kg/ha), medium in available phosphorus (39.20 kg/ha) and high in available potassium (302.50 kg/ha). The soil was slightly alkaline in reaction (pH 7.7). The treatment consisted of integrated nitrogen management *viz*.,100% RDF (80 :40:0 NPK/ha) through inorganic fertilizer + biocompost @ 10 t/ha ($T_1$), 100% RDN through inorganic fertilizer ($T_2$), 75% RDN through inorganic fertilizer + 25% RDN through biocompost ($T_3$), 75% RDN through inorganic fertilizer + 25% RDN through biocompost + biofertilizer ($T_4$), 50% RDN through inorganic fertilizer + 50%

RDN through biocompost ($T_5$) and 50% RDN through inorganic fertilizer + 50% RDN through biocompost + biofertilizer ($T_6$) to sorghum in *rabi* season. The treatments are evaluated in randomized block design (RBD) with four replications.

Sorghum cv. GJ-38 was sown with spacing of 45 cm x 10 cm in the third week of October and harvested in second week of February during both the years. Biocompost was applied as per treatment before sowing and mixed well in soil. Biofertilizers (Azospirillum and PSB) are also applied as per treatment in liquid form @ 2.5 lit/ha each in soil before sowing. Net plot yield was converted into hectare basis. In case of chemical analysis, soil samples are collected and analyzed for various nutrients by standard procedure. Statistical analysis was worked out as per the method described by Panse and Sukhatme (1967).

## Result and discussion

### Nutrient content and uptake

Nitrogen content in grain and stover, while N, P and K uptake by grain, stover and total uptake were significantly influenced due to different INM treatments (Table 1). Treatment 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha recorded maximum nitrogen, phosphorus and potassium content in grain and stover. The higher concentration of nutrient in sorghum grain and stover might be due to addition of more nutrient in soil through application of organic and inorganic sources of nutrients which in turn increased efficiency of applied nitrogen. The findings in sorghum crop are in accordance with those reported by Jat *et al* (2003) and Patel (2015). On pooled data basis, significantly higher total uptake of N, P and K by sorghum crop was observed with 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha. The nutrient uptake is a function of yield and nutrient concentration in plant. This might be due to higher crop biomass production due to better nourishment resulted into higher uptake. The findings were in accordance with Gangwar and Niranjan (1991) and Patel (2015) who reported higher nutrient uptake by sorghum in application of organic with inorganic fertilization.

### Protein content and protein yield

Protein content in sorghum grain and protein yield was found significant due to influence of INM treatments (Table 2). On basis of pooled result, maximum protein content was recorded under application of 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha. The increase in protein content of sorghum grain due to more quantity of nitrogen content in grain which resulted into improvement in metabolic activities in the plant. This results support the findings of Jat *et al.* (2003). Similarly, significantly maximum protein yield being under the application 100% RDF through inorganic fertilizer + biocompost @ 10 tonnes/ha over rest of INM treatments. This was may be due to the higher protein content and higher grain yield under this treatment. Jat *et al*. (2003), Patidar and Mali (2004) and Patel (2015) also reported the significant response of protein yield to INM in sorghum.

### Grain and stover yield

The differences in grain yield and stover yield were up to the level of significance (Table 2). Among INM, 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha gave significantly superior grain and stover yield compared to rest of treatments. On pooled data basis, the magnitude of increase in grain yield with application of 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha ($T_1$) was 13.99, 14.40, 21.61, 31.62 and 38.97 per cent over $T_2$, $T_4$, $T_3$, $T_6$ and $T_5$ treatments, respectively, while in case of stover yield it was 9.27, 16.03, 18.09, 20.82 and 22.66 per cent over $T_2$, $T_4$, $T_3$, $T_6$ and $T_5$ treatments, respectively. The remarkable increase in grain yield and stover yield under treatment 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha might be due to higher values of various growth attributes and yield attributes. All these parameters showed positive and significant correlation with grain and stover yield of sorghum. These findings are in close agreement with those reported by Ponnuswamy *et al.* (2002) in 100% RDF + FYM @ 10t/ha + biofertilizers, Sonune *et al.* (2003) with RDF + 10t/ha FYM, Patidar and Mali (2004) in application of 100% RDF + 10 t/ha as well as Patel (2015) with 100% RDF + FYM 10t/ha.

### Economics

Maximum net returns of 59146 ₹/ha with BCR of 2.64 was recorded with the treatment receiving 100% RDF through inorganic fertilizer + biocompost @ 10 t/ha fallowed by application of 100% RDF through inorganic fertilizer with net returns of 53449 ₹/ha with BCR of 2.72 over rest of treatments. This might be due to higher yield of crop with this treatment. Similar results reported earlier by Mahakulkar *et al* (1998), Jat *et al*. (2003) and Patel (2015) in sorghum crop.

**Table 1:** Effect of INM on nutrients (NPK) content and uptake by sorghum (pooled result of two years)

| Treatments | Nutrient content (%) | | | | | | Nutrient uptake (kg/ha) | | | | | | Total uptake | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nitrogen | | Phosphorus | | Potassium | | Nitrogen | | Phosphorus | | Potassium | | | | |
| | Grain | Stover | Grain | Stover | Grain | Stover | Grain | Stover | Grain | Stover | Grain | Stover | N | P | K |
| $T_1$ | 1.52 | 0.56 | 0.398 | 0.188 | 0.78 | 0.95 | 52.68 | 48.60 | 13.78 | 16.35 | 26.94 | 82.82 | 101.28 | 30.13 | 109.76 |
| $T_2$ | 1.48 | 0.54 | 0.396 | 0.182 | 0.76 | 0.94 | 44.96 | 43.11 | 12.03 | 14.52 | 23.15 | 74.41 | 88.07 | 26.55 | 97.56 |
| $T_3$ | 1.44 | 0.50 | 0.383 | 0.178 | 0.70 | 0.91 | 40.87 | 36.83 | 10.87 | 13.10 | 19.91 | 67.23 | 77.70 | 23.97 | 87.14 |
| $T_4$ | 1.45 | 0.51 | 0.396 | 0.183 | 0.74 | 0.92 | 43.96 | 38.49 | 11.98 | 13.77 | 22.40 | 69.27 | 82.46 | 25.75 | 91.67 |
| $T_5$ | 1.39 | 0.48 | 0.378 | 0.173 | 0.66 | 0.89 | 34.57 | 34.14 | 9.41 | 12.30 | 16.40 | 63.16 | 68.71 | 21.70 | 79.56 |
| $T_6$ | 1.42 | 0.48 | 0.384 | 0.177 | 0.69 | 0.91 | 37.18 | 35.00 | 10.09 | 12.89 | 18.13 | 65.24 | 72.18 | 22.98 | 83.37 |
| S.Em± | 0.02 | 0.008 | 0.007 | 0.005 | 0.034 | 0.02 | 1.40 | 0.96 | 0.43 | 0.35 | 1.36 | 2.07 | 1.57 | 0.54 | 3.03 |
| C.D. at 5% | 0.05 | 0.02 | NS | NS | NS | NS | 4.22 | 2.89 | 1.29 | 1.05 | 4.11 | 6.25 | 4.74 | 1.62 | 9.12 |
| C.V.% | 2.46 | 3.13 | 3.63 | 5.47 | 9.49 | 5.18 | 6.61 | 4.87 | 7.56 | 5.03 | 12.88 | 5.90 | 3.85 | 4.27 | 6.61 |

$T_1$: 100% RDF through inorganic fertilizer + biocompost @ 10 tonnes/ ha, $T_2$: 100% RDN through inorganic fertilizer, $T_3$: 75% RDN through inorganic fertilizer + 25% RDN through biocompost, $T_4$: 75% RDN through inorganic fertilizer + 25% RDN through biocompost + biofertilizers, $T_5$: 50% RDN through inorganic fertilizer + 50% RDN through biocompost, $T_6$: 50% RDN through inorganic fertilizer + 50% RDN through biocompost + biofertilizers, $T_7$: Fallow

**Table 2:** Protein content, protein yield and yield of sorghum as influenced by INM different treatments

| Treatments | Protein content (%) | | | Protein yield (kg/ha) | | | Grain yield (pooled) | Stover yield (pooled) | Net monetary returns (Rs/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled | | | |
| $T_1$: 100% RDF through inorganic fertilizer + biocompost @ 10 tonnes/ ha | 9.41 | 9.64 | 9.53 | 319.64 | 338.81 | 329.22 | 34.55 | 87.14 | 59146 |
| $T_2$: 100% RDN through inorganic fertilizer | 9.25 | 9.28 | 9.27 | 275.98 | 286.01 | 281.00 | 30.31 | 79.75 | 53449 |
| $T_3$: 75% RDN through inorganic fertilizer + 25% RDN through biocompost | 8.95 | 9.03 | 8.99 | 250.50 | 260.38 | 255.44 | 28.41 | 73.79 | 47914 |
| $T_4$: 75% RDN through inorganic fertilizer + 25% RDN through biocompost + biofertilizers | 9.01 | 9.17 | 9.09 | 267.67 | 281.89 | 274.78 | 30.20 | 75.10 | 51387 |
| $T_5$: 50% RDN through inorganic fertilizer + 50% RDN through biocompost | 8.59 | 8.79 | 8.69 | 204.01 | 228.15 | 216.08 | 24.86 | 71.04 | 40043 |
| $T_6$: 50% RDN through inorganic fertilizer + 50% RDN through biocompost + biofertilizers | 8.72 | 8.97 | 8.85 | 216.89 | 247.84 | 232.37 | 26.25 | 72.12 | 42647 |
| S.Em± | 0.18 | 0.16 | 0.11 | 11.38 | 10.72 | 8.75 | 0.82 | 1.88 | - |
| C.D. at 5% | 0.54 | 0.48 | 0.34 | 34.30 | 32.32 | 26.37 | 2.48 | 5.68 | - |
| C.V.% | 3.95 | 3.51 | 2.46 | 8.90 | 7.83 | 6.61 | 5.65 | 4.93 | - |

## References


1. Gangwar KS, Niranjan KP. Effect of organic manures and inorganic fertilizers on rainfed fodder sorghum (Sorghum bicolor). Indian J. Agric. Sci. 1991; 61(3):193-194.
2. Jat SL, Smeriya HK, Mehta YK. Influence of integrated nutrient management on content and uptake of nutrient on sorghum. Crop Res. 2003; 26(3):390-394.
3. Mahakulkar BV, Wanjari SS, Atale SB, Potdukhe NR, Deshmukh JP. Integrated nutrient management in sorghum (Sorghum bicolor)- based cropping system. Indian Journal of Agronomy, 1998; 43(3):376-381.
4. Panse VG, Sukhatme PV. Statistical methods for Agricultural Workers. ICAR, New Delhi, 1967, 199-200.
5. Patel BK. Effect of land configuration and integrated nutrient management on productivity of different verieties of sorghum (Rabi) grown on fluventic ustochepts, Ph.D. thesis submitted to NAU, Navsari. (Gujarat)., 2015.
6. Patidar M, Mali AL. Effect of farmyard manure, fertility levels and Bio- fertilizer on growth, yield and quality of sorghum (Sorghum bicolar). Indian J. Agron. 2004; 49(2):117-120.
7. Ponnuswamy K, Subbian P, Santhi P, Sankaran N. Integrated nutrent management for rainfed sorghum. Crop Res., 2002; 23(2):243-246.
8. Sonune BA, Tayade KB, Gabhane VV, Puranic RB. Long term effect of manuring and fertilisation on fertility and crop productivity of Vertisols under sorghum wheat sequence. Crop Res., 2003; 25(3):460-467.