International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 920-924

Received: 16-07-2017
Accepted: 18-08-2017

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# Status of NPK and protein in fodder of multicut forage sorghum grown under different fertility levels and varieties

**Vinay Arya, Hemlata Dhakad, Swarnima Shrivastava, Renu Pathak and Shashi S Yadavs**

**Abstract**
An investigation on "Status of NPK and protein in fodder of multicut forage sorghum grown under different fertility levels and varieties" under adoptive climatic conditions of Northern part of Madhya Pradesh was carried out during *Kharif* season 2014 at the Research Farm, College of Agriculture, R.V.S.K.V.V., Gwalior (M.P.). The experiment was laid out in factorial randomzied block design (F.R.B.D.) replicated three times with 12 treatment combinations, namely $T_1$ (10 t of FYM + ICSSH-28), $T_2$ (50% of RDF + ICSSH-28), $T_3$ (50% of RDF + 5 t FYM + Azotobacter + PSB + ICSSH-28), $T_4$ (75% RDF + ICSSH-28), $T_5$ (75% of RDF + 2.5 t FYM + Azotobacter + PSB + ICSSH-28), $T_6$ (100% RDF + ICSSH- 28), $T_7$ (10 t of FYM + IS-17349), $T_8$ (50% of RDF + IS-17349), $T_9$ (50% of RDF + 5 t FYM + Azotobacter + PSB + IS-17349), $T_{10}$ (75% RDF + IS-17349), $T_{11}$ (75% of RDF + 2.5 t FYM + Azotobacter + PSB + IS-17349) and $T_{12}$ (100% RDF + IS-17349). Sorghum varieties were grown by considering recommended package of practices. It is evident from results that under both cutting, treatment 10 t of FYM ($F_1$) showed higher nitrogen, potassium and protein content in fodder, which was significantly superior over rest of the treatments. Under both cutting; treatment 75% of RDF + 2.5 t FYM + Azotobacter + PSB ($F_5$) showed higher phosphorus content in fodder, which was significantly superior over rest of the treatments. At both cut; maximum nitrogen, potassium and protein content in fodder was recorded with $V_1F_1$ followed by $V_2F_1$ which are statistically at par from each other and significantly higher over rest of other treatment combination while maximum phosphorus content in fodder was recorded with $V_1F_5$ followed by $V_2F_5$ which are statistically at par from each other and significantly higher over rest of other treatment combination.

**Keywords:** sorghum, nitrogen, phosphorus, potassium, protein.

## Introduction
Sorghum is one of the most important fodder crops in rainfed conditions of India, being a short duration, drought and salt tolerant, well adaptive to arid regions is considered promising crop to overcome the green fodder for animals. Sorghum crop occupies around 30% of the cultivated area under forages and therefore attracts greater attention of researchers for improvement in herbage productivity and quality (Dhar *et al*., 2005) [3]. It is cultivated under rain-fed condition on soils having low fertility. In such environmental conditions, nutrient stress resulted in low productivity. Poor soil fertility coupled with inadequate and imbalanced nutrition and low/no application of organic manures is another important constraint for success crop production under rainfed conditions (Ramesh *et al.*, 2009) [6]. This requires development of the supply of nutrients through organic and inorganic sources wich may fulfill long nutrient demand of crop. High crop yield can be obtained with judicious and balanced inorganic fertilization combined with organic amendments. In intensive agriculture involvement of high yielding varieties has lead to heavy removal of nutrients from soil and fertilizer consumption generally remained much below as compared to removal. This gap can be bridged by using organic matter with inorganic fertilizer only. To achieve higher yield of crops it is essential to provide them the optimum level of their nutrients requirement.

## Materials and Methods
The present investigation entitled “Status of NPK and protein in fodder of multicut forage sorghum grown under different fertility levels and varieties” was carried out during *kharif* season of 2014 at the research farm of College of Agriculture, Gwalior; Madhya Pradesh.

**Table 1:** Treatments details

| A. Varieties | |
|---|---|
| $V_1$ | ICSSH 28 (White) |
| $V_2$ | IS17349 (Reddish) |
| B. Fertility levels | |
| $F_1$ | 10 t of FYM |
| $F_2$ | 50% of RDF |
| $F_3$ | 50% of RDF + 5 t FYM + Azotobacter + PSB |
| $F_4$ | 75% RDF |
| $F_5$ | 75% of RDF + 2.5 t FYM + Azotobacter + PSB |
| $F_6$ | 100% RDF |

**Table 2:** Treatment combinations along with their symbols

| Treatment combinations | Symbol |
|---|---|
| 10 t of FYM + ICSSH 28 | $T_1$ |
| 50% of RDF + ICSSH 28 | $T_2$ |
| 50% of RDF + 5 t FYM + Azotobacter + PSB + ICSSH 28 | $T_3$ |
| 75% RDF + ICSSH 28 | $T_4$ |
| 75% of RDF + 2.5 t FYM + Azotobacter + PSB + ICSSH 28 | $T_5$ |
| 100% RDF + ICSSH 28 | $T_6$ |
| 10 t of FYM + IS17349 | $T_7$ |
| 50% of RDF + IS17349 | $T_8$ |
| 50% of RDF + 5 t FYM + Azotobacter + PSB + IS17349 | $T_9$ |
| 75% RDF + IS17349 | $T_{10}$ |
| 75% of RDF + 2.5 t FYM + Azotobacter + PSB + IS17349 | $T_{11}$ |
| 100% RDF + IS17349 | $T_{12}$ |

For the present study, Plant sample were collected and dried in oven at 70°C for 48 hours. Dried samples were ground in an electric grinder. These samples were used for the analysis of NPK.

- **Determination of Nitrogen**

Nitrogen in plant sample was determined by KEL PLUS nitrogen estimation system (PELICAN Equipments).

Pelicans KEL PLUS System are developed and designed to perform the Kjeldahl chemistry. Kjeldahl method is developed to estimate Nitrogen which consists of the following three processes:

1. Digestion
2. Distillation
3. Titration

**1. Digestion Process**

In this process, 0.5 g of plant sample was transferred to the digestion tube. 10 ml of concentrated sulphuric acid and 2g of digestion activator (Salt mixture) to the sample were added. Digestion tubes were loaded in to the digester and the digestion block was heated. At the end of digestion process, the sample turned colourless or light green colour.

**2. Distillation process**

During distillation, the ammonium radicals are converted to ammonia under excess alkali condition after neutralizing the acid in the digested sample with 40% alkali (NaOH) on heating. In DISTYL-EM, the digested samples are heated by passing steam and the ammonia librated due to the addition of 40% NaOH is dissolved in 4% boric acid. The boric acid consisting of ammonia is taken for titration.

**3. Titration Process**

The solution of boric acid and mixed indicator containing the "distilled off" ammonia was titrated with the standardized $H_2SO_4$. The titration value of a blank solution of boric acid and mixed indicator was determined.

$$\% \text{ Nitrogen} = \frac{(\text{Sample titer} - \text{Blank titer}) \times \text{Normality of } H_2SO_4 \times 14 \times 100}{\text{Sample weight (g)} \times 1000}$$

- **Determination of phosphorus and potassium**

1 g oven dried plant sample was taken and digested in 100 ml conical flask with 10 ml of di-acid mixture (2:5) consisting of chemically pure concentrated perchloric acid and nitric acid respectively and digested material was filtered through Whatman No. 40 filter paper in 100 ml. volumetric flask and filtrate was diluted to mark. This was used for estimation of P and K.

**Phosphorus estimation**

10 ml of aliquot from the colourless filtrate was taken in 25 ml. volumetric flask for determination and then 5 ml of ammonium molybdate vanadate mixture was added to it and volume was made up to 25 ml. after shaking well. It was kept for 30 minutes and colour intensity was measured in Spectronic 20 at 470 nm wave length, after setting the instrument to zero with blank as described by Jackson (1967) [4].

**Potassium estimation**

10 ml aliquot of the filtrate was taken in 100 ml volumetric flask and it was diluted to mark with distilled water. The potassium content in extract was estimated by flame photometer (Black, 1965) [2].

- **Protein content**

Protein was computed by multiplying the N content of seed with a factor of 6.25. The total N content was determined by adopting modified kjeldahl's method as described by A.O.A.C. (1984) [1].

**Results and Discussion**

Observations recorded during the course of investigation. Nutrients (nitrogen, phosphorus and potassium) along with protein content (%) in fodder were statistically analysed and are presented under various heads. The results of investigation have been illustrated with figures and diagrams wherever necessary.

**Effect of varieties**

The variety ICSSH-28 ($V_1$) showed higher nutrient (N, P and K) and protein content over variety IS-17349 ($V_2$).

**Effect of fertility levels**

It is evident from results that under both cutting, treatment 10 t of FYM ($F_1$) showed higher nitrogen, potassium and protein content in fodder, which was significantly superior over rest of the treatments.

Under both cuttings treatment 75% of RDF + 2.5 t FYM + Azotobacter + PSB ($F_5$) showed higher phosphorus content in fodder, which was significantly superior over rest of the treatments.

The increase in content of N, P, K and protein in sorghum forage with FYM, PSB and biofertilizer application are probably because of the improvement of soil environment, which encouraged root proliferation, which in turn drew more water and nutrients from larger area and also from deeper layer. Further, FYM after decomposition released major and micronutrients, which become easily available to the plants and thus increased the uptake.

**Interaction effect of varieties and fertility levels**

At both cut; maximum nitrogen, potassium and protein content in fodder was recorded with $V_1F_1$ (ICSSH-28 + 10 t of FYM) followed by $V_2F_1$ (IS-17349 + 10 t of FYM) which are statistically at par from each other and significantly higher over rest of other treatment combination while maximum phosphorus content in fodder was recorded with $V_1F_5$ (ICSSH-28: 75% of RDF + 2.5 t FYM + Azotobacter + PSB) followed by $V_2F_5$ (IS-17349: 75% of RDF + 2.5 t FYM + Azotobacter + PSB) which are statistically at par from each other and significantly higher over rest of other treatment combination. The results also confirm the findings of Singh and Sumeriya (2005) [7].

**Table 3:** Effect of varieties and fertility levels on the nitrogen content (%) in fodder of sorghum

| Treatments | Nitrogen content (%) in fodder | | | | | |
|---|---|---|---|---|---|---|
| | I st Cut | | | II nd Cut | | |
| | V1: ICSSH 28 | V2: IS17349 | Mean | V1: ICSSH 28 | V2: IS17349 | Mean |
| F1: 10 t of FYM | 0.833 | 0.827 | 0.830 | 0.800 | 0.810 | 0.805 |
| F2: 50% of RDF | 0.640 | 0.540 | 0.590 | 0.613 | 0.527 | 0.570 |
| F3: 50% of RDF + 5 t FYM + Azotobacter + PSB | 0.780 | 0.763 | 0.772 | 0.763 | 0.747 | 0.755 |
| F4: 75% RDF | 0.670 | 0.647 | 0.658 | 0.653 | 0.640 | 0.647 |
| F5: 75% of RDF + 2.5 t FYM + Azotobacter + PSB | 0.780 | 0.703 | 0.742 | 0.760 | 0.683 | 0.722 |
| F6: 100% RDF | 0.730 | 0.640 | 0.685 | 0.713 | 0.620 | 0.667 |
| Mean | 0.739 | 0.687 | | 0.717 | 0.671 | |
| | V | F | VXF | V | F | VXF |
| S.E.(m)± | 0.007 | 0.012 | 0.018 | 0.007 | 0.012 | 0.018 |
| C.D. (at 5%) | 0.021 | 0.037 | 0.052 | 0.021 | 0.037 | 0.052 |

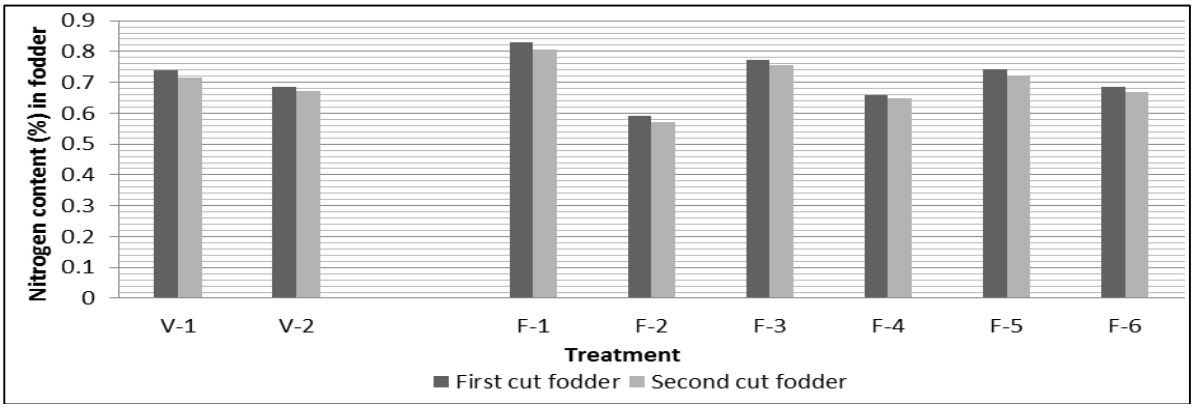



**Table 4:** Effect of varieties and fertility levels on the phosphorus content (%) in fodder of sorghum

| Treatments | Phosphorus content (%) in fodder | | | | | |
|---|---|---|---|---|---|---|
| | I st Cut | | | II nd Cut | | |
| | V1: ICSSH 28 | V2: IS17349 | Mean | V1: ICSSH 28 | V2: IS17349 | Mean |
| F1: 10 t of FYM | 0.180 | 0.110 | 0.145 | 0.173 | 0.103 | 0.138 |
| F2: 50% of RDF | 0.123 | 0.093 | 0.108 | 0.120 | 0.090 | 0.105 |
| F3: 50% of RDF + 5 t FYM + Azotobacter + PSB | 0.223 | 0.220 | 0.222 | 0.220 | 0.217 | 0.218 |
| F4: 75% RDF | 0.180 | 0.127 | 0.153 | 0.173 | 0.123 | 0.148 |
| F5: 75% of RDF + 2.5 t FYM + Azotobacter + PSB | 0.267 | 0.263 | 0.265 | 0.260 | 0.257 | 0.258 |
| F6: 100% RDF | 0.210 | 0.200 | 0.205 | 0.207 | 0.197 | 0.202 |
| Mean | 0.197 | 0.169 | | 0.192 | 0.164 | |
| | V | F | VXF | V | F | VXF |
| S.E.(m)± | 0.005 | 0.008 | 0.012 | 0.004 | 0.008 | 0.011 |
| C.D. (at 5%) | 0.014 | 0.025 | 0.035 | 0.013 | 0.023 | 0.032 |

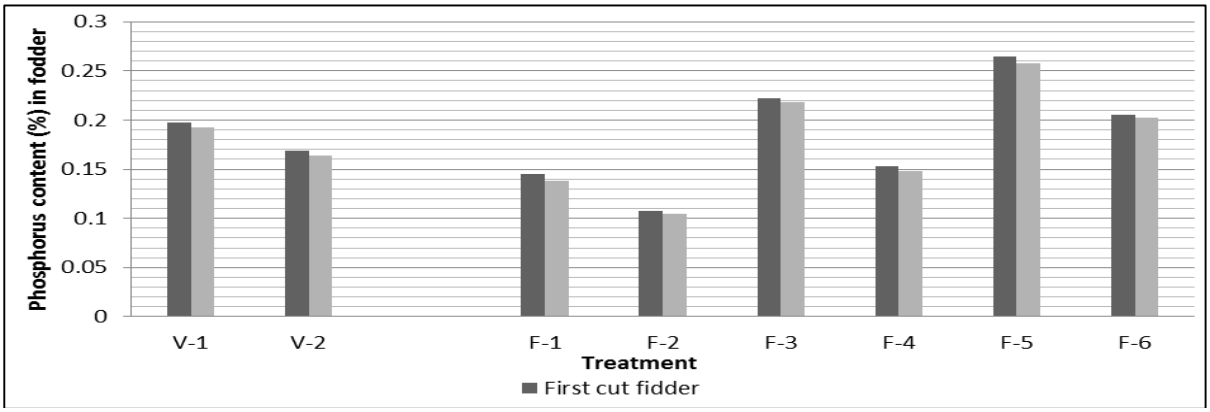


**Table 5:** Effect of varieties and fertility levels on the potassium content (%) in fodder of sorghum

| Treatments | Potassium content (%) in fodder | | | | | |
|---|---|---|---|---|---|---|
| | I st Cut | | | II nd Cut | | |
| | V1: ICSSH 28 | V2: IS17349 | Mean | V1: ICSSH 28 | V2: IS17349 | Mean |
| F1: 10 t of FYM | 1.533 | 1.527 | 1.530 | 1.463 | 1.467 | 1.465 |
| F2: 50% of RDF | 1.340 | 1.213 | 1.277 | 1.290 | 1.190 | 1.240 |
| F3: 50% of RDF + 5 t FYM + Azotobacter + PSB | 1.480 | 1.463 | 1.472 | 1.427 | 1.413 | 1.420 |
| F4: 75% RDF | 1.370 | 1.333 | 1.352 | 1.320 | 1.287 | 1.303 |
| F5: 75% of RDF + 2.5 t FYM + Azotobacter + PSB | 1.480 | 1.403 | 1.442 | 1.423 | 1.343 | 1.383 |
| F6: 100% RDF | 1.430 | 1.340 | 1.385 | 1.377 | 1.273 | 1.325 |
| Mean | 1.439 | 1.380 | | 1.383 | 1.329 | |
| | V | F | VXF | V | F | VXF |
| S.E.(m)± | 0.008 | 0.014 | 0.020 | 0.008 | 0.014 | 0.020 |
| C.D. (at 5%) | 0.024 | 0.042 | 0.059 | 0.024 | 0.041 | 0.058 |

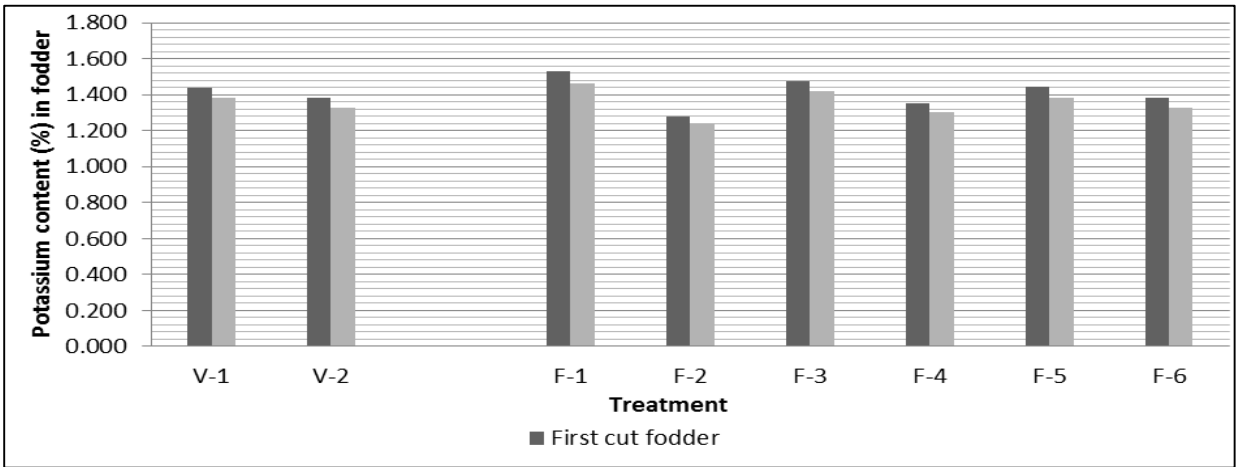
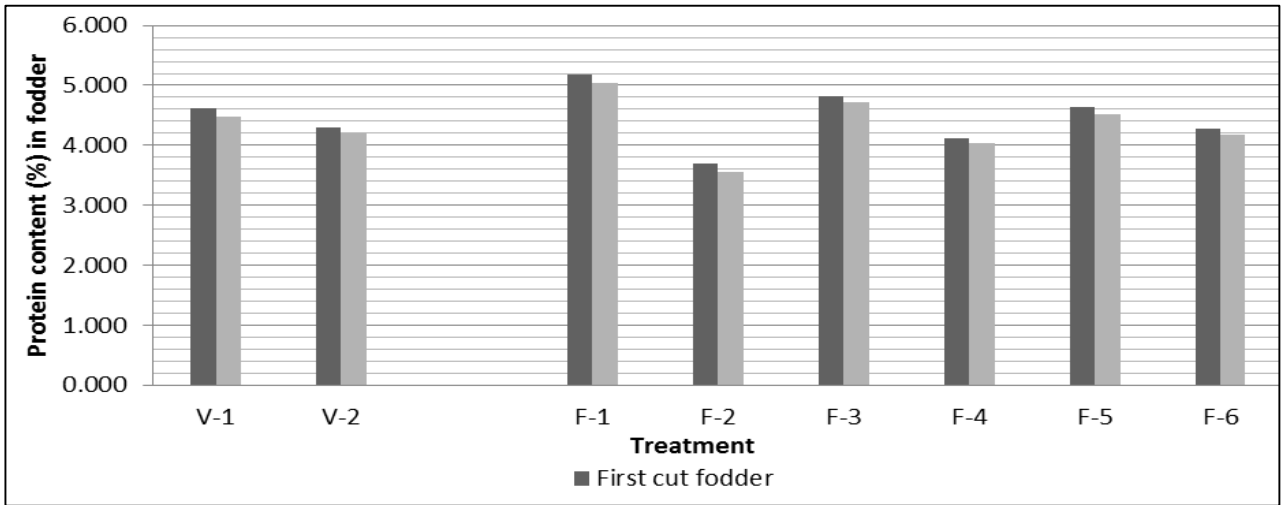



**Table 6:** Effect of varieties and fertility levels on the protein content (%) in fodder of sorghum

| Treatments | Protein content (%) in fodder | | | | | |
|---|---|---|---|---|---|---|
| | I st Cut | | | II nd Cut | | |
| | V1: ICSSH 28 | V2: IS17349 | Mean | V1: ICSSH 28 | V2: IS17349 | Mean |
| F1: 10 t of FYM | 5.208 | 5.167 | 5.188 | 5.000 | 5.063 | 5.031 |
| F2: 50% of RDF | 4.000 | 3.375 | 3.688 | 3.833 | 3.292 | 3.563 |
| F3: 50% of RDF + 5 t FYM + Azotobacter + PSB | 4.875 | 4.771 | 4.823 | 4.771 | 4.667 | 4.719 |
| F4: 75% RDF | 4.188 | 4.042 | 4.115 | 4.083 | 4.000 | 4.042 |
| F5: 75% of RDF + 2.5 t FYM + Azotobacter + PSB | 4.875 | 4.396 | 4.635 | 4.750 | 4.271 | 4.510 |
| F6: 100% RDF | 4.563 | 4.000 | 4.281 | 4.458 | 3.875 | 4.167 |
| Mean | 4.618 | 4.292 | | 4.483 | 4.194 | |
| | V | F | VXF | V | F | VXF |
| S.E.(m)± | 0.045 | 0.078 | 0.110 | 0.045 | 0.078 | 0.110 |
| C.D. (at 5%) | 0.133 | 0.230 | 0.325 | 0.133 | 0.230 | 0.325 |



**Acknowledgement**
The authors express thanks to Head, Department of Soil Science and Agricultural Chemistry and Research Farm, College of Agriculture, R.V.S.K.V.V., Gwalior (M.P.) for providing all the facilities to conduct work.

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