International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 4491-4493

Received: 13-07-2019
Accepted: 15-08-2019

**Sandeep Navrang**
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

**Sunil Kumar**
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

**Manju Tandon**
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

**Corresponding Author:**
**Sandeep Navrang**
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

# Effect of nutrient management practices and cropping system on concentration and uptake of nutrients in soybean (*Glycine max* L. Merril)

**Sandeep Navrang, Sunil Kumar and Manju Tandon**

**Abstract**
A field experiment was conducted at Research cum instructional Farm, IGKV, Raipur during *Kharif* 2018 and 2019, to study the effect of nutrient management practices and cropping system on concentration and uptake of nutrients in soybean. The six (6) treatments of nutrient management and four cropping system (CS) *viz.* ($NM_1$) 100% RDN through organic sources, ($NM_2$) 75% RDN through organic sources + foliar spray of VW (10%) fb CU (10%) at 30 and 50 DAS/DAT, ($NM_3$) 50% RDN through organic + 50% RDN through inorganic sources, ($NM_4$) 75% RDN through organic+ 25% RDN through inorganic sources, ($NM_5$)100% RDN through inorganic sources, ($NM_6$)100% RDN through inorganic sources + FYM @ 5t $ha^{-1,}$ and ($CS_1$) soybean -sweet corn, ($CS_2$) soybean -garden pea, ($CS_3$) soybean-chilli and ($CS_4$) soybean-onion were tested in strip plot design with three replications. The significantly highest nitrogen, phosphorus and potassium uptake by grain in $NM_2$, while the highest uptake by stover in $NM_1$ and total uptake was observed in $NM_2$ except potassium. Whereas the effect of cropping system was non significant during the investigation.

**Keywords:** Soybean, cropping system, nutrient uptake

## Introduction
Soybean (*Glycine max* L. Merril) is the 2nd most important oilseed crop after groundnut. It is also known as gold of 20th century due to its easy cultivation, high cost: benefit ratio, less requirement of nitrogen etc. It has atmospheric nitrogen fixing ability and deep root system; thus soybean cultivation enhances soil health. It contains about 40 per cent protein, 18-20 per cent oil, 26 per cent carbohydrates, 2 per cent phospholipids and 4 per cent minerals (Haldankar *et al*., 1992) [6]. The origin of soybean is reported to be in eastern Asia or China. According to Food and Agriculture Organization (FAO), during 2018-19, area under soybean cultivation in the world was 125.69 million hectares, with global production of 362.08 million metric tonnes and productivity of 2088 kg $ha^{-1}$ (Anonymous, 2019) [2]. India occupies an area of 11.8 million hectare, with 12.5 million tonnes production and about 1228 kg $ha^{-1}$ productivity during 2018-19 (Anonymous, 2019) [2]. The estimate for cost of production of soybean during 2017-18 accounts for about Rs. 2121 $q^{-1}$ of produce. During 2018-19, the area under soybean cultivation in Chhattisgarh was limited to 128.1 thousand hectare with productivity of 865 kg per hectare (Anonymous, 2018) [1]. Soybean is important kharif crop in Chhattisgarh grown under upland, unbunded heavy black soils (*Vertisols*) locally known as "*Bharri*".

Combination of vermicompost and vermiwash recorded a marked effect on the biochemical characteristics of the soil with significant improvement in soil micronutrients and better qualitative improvement in the physical and chemical properties of the soil (Ansari and Sukhraj, 2010) [3]. Arbad and Ismail (2011) [4] reported that the peak uptake of nutrients N, P and K in soybean and safflower was observed after applying 100% RDF + FYM @ 10 Mg $ha^{-1}$. Tiwari *et al.* (2002) [8] reported that conjunctive use of synthetic fertilizer with farm manure increased soybean yield by 142%. Integrated uses of organics and inorganics not only increase the crop yield but also improve the soil quality.

## Material and method

A field experiment was carried out at Research cum instructional Farm, IGKV, Raipur during *Kharif* 2018 and 2019.The soil of experimental field was '*Vertisols*' which is locally known as '*kanhar*'.The soil was neutral in reaction and medium in fertility levels having low in N, medium in P and high in K. The six (6) treatments of nutrient management and four cropping system (CS) *viz.* ($NM_{1)}$ 100% RDN through organic sources, ($NM_2$) 75% RDN through organic sources + foliar spray of VW (10%) fb CU (10%) at 30 and 50 DAS/DAT, $NM_3$ -50% RDN through organic + 50% RDN through inorganic sources, ($NM_4$) 75% RDN through organic+ 25% RDN through inorganic sources, ($NM_{5)}$100% RDN through inorganic sources, ($NM_{6)}$100% RDN through inorganic sources + FYM @ 5t $ha^{-1,}$ and ($CS_{1)}$ soybean -sweet corn, ($CS_{2)}$ soybean -garden pea, ($CS_3$) soybean-chilli and ($CS_4$) soybean-onion were tested in strip plot design with three replications. The soybean cultivar 'JS- 9752' was used during the investigation. All the organic source of nutrients such as vermicompost, neem cake and FYM were used before the sowing of crop and in split doses as per the required of treatments in respective plots to fulfil the nutrient requirement 30:60:30 kg $N:P_2O_5:K_2O$ $ha^{-1}$. The N, P and K content of different available organic manures were determined in laboratory and accordingly, and required quantity were applied in different treatment on the basis of nitrogen content (%) of organic sources. P was supplemented through rock phosphate (22% $P_2O_5$) after adjusting the quantity of P supplied through manures.

## Result and discussion

### Nutrient concentration (%) in grain and stover of soybean

The major nutrient concentration (%) such as N, P and K in grain and stover of soybean were influenced by nutrient management practices and cropping system are presented in table 1. The data on the nitrogen, phosphorus and potassium concentration in the grain of soybean were evident from the report that the difference made due to several nutrient management practices, cropping systems and their interaction appeared to be non significant. However, the highest N, P and K concentration were noticed in $NM_6$ *i.e.* application of 100% RDN through inorganic sources along with FYM @ 5t $ha^{-1}$. The N, P and K concentration (%) in stover also was found non significant.

**Table 1:** Effect of nutrient management practices and cropping system on nutrient concentration in grain and stover of soybean

| Treatments | Nutrient concentration (%) | | | | | |
|---|---|---|---|---|---|---|
| | Nitrogen | | Phosphorus | | Potassium | |
| | Grain | stover | Grain | stover | Grain | stover |
| **Nutrient management** | | | | | | |
| $NM_1$ -100% RDN through organic sources | 6.17 | 0.67 | 0.59 | 0.20 | 0.72 | 1.43 |
| $NM_2$ -75% RDN through organic sources + foliar spray of VW (10%) fb CU (10%) at 30 and 50 DAS/DAT | 6.18 | 0.67 | 0.59 | 0.20 | 0.72 | 1.45 |
| $NM_3$ -50% RDN through organic + 50% RDN through inorganic sources | 6.13 | 0.62 | 0.56 | 0.18 | 0.71 | 1.42 |
| $NM_4$ -75% RDN through organic+ 25% RDN through inorganic sources | 6.14 | 0.65 | 0.56 | 0.19 | 0.70 | 1.41 |
| $NM_5$ -100% RDN through inorganic sources | 6.19 | 0.64 | 0.57 | 0.19 | 0.70 | 1.47 |
| $NM_6$ -100% RDN through inorganic sources + FYM @ 5t $ha^{-1}$ | 6.23 | 0.65 | 0.58 | 0.21 | 0.74 | 1.48 |
| SEm± | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS |
| **Cropping system** | | | | | | |
| $CS_1$ -Soybean -sweet corn | 6.14 | 0.64 | 0.58 | 0.19 | 0.71 | 1.44 |
| $CS_2$ - Soybean -garden pea | 6.21 | 0.65 | 0.59 | 0.20 | 0.72 | 1.44 |
| $CS_3$ - Soybean-chilli | 6.18 | 0.65 | 0.59 | 0.20 | 0.71 | 1.44 |
| $CS_4$ - Soybean-onion | 6.17 | 0.65 | 0.54 | 0.19 | 0.71 | 1.45 |
| SEm± | 0.02 | 0.01 | 0.03 | 0.00 | 0.01 | 0.01 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS |
| N X C | NS | NS | NS | NS | NS | NS |

### Grain, stover and total nutrient uptake by soybean

The data on N, P and K nutrient uptake (kg $ha^{-1}$) in grain and stover of soybean were influenced by nutrient management practices and cropping system are presented in table 2. The maximum nitrogen uptake by the grain in ($NM_2$) 75% RDN through organic sources + foliar spray of VW (10%) fb CU (10%) at 30 and 50 DAS/DAT. Where is the maximum nitrogen uptake by stover by ($NM_1$) 100% RDN through organic sources, while the total nitrogen uptake by the soybean was observed in ($NM_1$). Increase in the concentration of nitrogen in seeds of soybean than in the straw indicates suggesting efficient translocation of nutrients from source to the sink. After cow urine application, there was increase in the soil microbial count which released several enzymes. It seems that the uptake of nutrient ions by crop increased as there were lots of enzymes secreted by the microbes. The result confirms the findings of Singh *et al.* (2015), who suggested that the highest N and P concentration in soybean plants after harvest was seen with the application of FYM @ 5 t $ha^{-1}$ + vermicompost @ 2.5 t $ha^{-1}$ + vermiwash @ 10 % + 50 % NPK. Similar findings were also reported by Vahanka *et al.* (2010) and Singh *et al.* (2014). In case of phosphorus uptake same trend was noticed. Organic manures have always helped in increase inorganic ions and humic substances (Canellas *et al.*, 2002) thereby enhancing root proliferation (Rose *et al.*, 2001) increasing the nutrient uptake through extensive root system. More the length of root higher will be its nutrient uptaking capability increasing plant growth. The higher uptake in 100% organically managed plot might be as a result of increase in share of organic manure (FYM, vermicompost and neemcake) applied to the soybean plants. The maximum potassium uptake by grain in ($NM_2$) 75% RDN through organic sources + foliar spray of VW (10%) fb CU (10%) at 30 and 50 DAS/DAT. While the maximum potassium uptake by stover and total potassium uptake by the ($NM_1$)100% RDN through organic sources. It could be possible that application of organic sources have enhanced the availablility of N, P and K and micro nutrients in the soil significantly, due to which

there was improvement in the uptake of nutrients. The vermicompost share of organic manures introduce the microorganisms in rhizosphere of plants, which lead to more availability of nitrogen and potassium by biological fixation of nitrogen and biological solubilization of phosphorus. As regards to the effect of cropping systems is concerned, the difference among the treatments was found non significant.

**Table 2:** Effect of nutrient management practices and cropping system on nutrient uptake in grain and stover of soybean

| Treatments | Nutrient uptake (kg ha$^{-1}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Nitrogen | | | Phosphorus | | | Potassium | | |
| | Grain | stover | Total | Grain | stover | Total | Grain | stover | Total |
| **Nutrient management** | | | | | | | | | |
| $NM_1$ -100% RDN through organic sources | 110.55 | 19.79 | 130.35 | 10.51 | 5.98 | 16.49 | 12.90 | 42.44 | 55.34 |
| $NM_2$ -75% RDN through organic sources + foliar spray of VW (10%) fb CU (10%) at 30 and 50 DAS/DAT | 119.65 | 18.20 | 137.85 | 11.33 | 5.38 | 16.70 | 13.96 | 39.51 | 53.46 |
| $NM_3$ -50% RDN through organic + 50% RDN through inorganic sources | 87.38 | 13.90 | 101.28 | 8.03 | 4.00 | 12.03 | 10.16 | 31.97 | 42.13 |
| $NM_4$ -75% RDN through organic+ 25% RDN through inorganic sources | 91.68 | 14.21 | 105.89 | 8.40 | 4.18 | 12.58 | 10.56 | 30.93 | 41.49 |
| $NM_5$ -100% RDN through inorganic sources | 96.83 | 13.85 | 110.68 | 8.88 | 4.17 | 13.06 | 11.14 | 31.72 | 42.87 |
| $NM_6$ -100% RDN through inorganic sources + FYM @ 5t ha$^{-1}$ | 106.15 | 15.47 | 121.62 | 9.92 | 4.95 | 14.87 | 12.59 | 35.31 | 47.90 |
| SEm± | 2.56 | 0.49 | 2.67 | 0.53 | 0.20 | 0.68 | 0.26 | 1.40 | 1.44 |
| CD (P=0.05) | 8.06 | 1.55 | 8.42 | 1.68 | 0.62 | 2.13 | 0.81 | 4.40 | 4.54 |
| **Cropping system** | | | | | | | | | |
| $CS_1$ -Soybean -sweet corn | 102.39 | 16.15 | 118.54 | 9.58 | 4.76 | 14.34 | 11.88 | 36.38 | 48.26 |
| $CS_2$ - Soybean -garden pea | 105.82 | 16.47 | 122.29 | 10.03 | 5.04 | 15.06 | 12.35 | 36.20 | 48.55 |
| $CS_3$ - Soybean-chilli | 100.08 | 14.84 | 114.91 | 9.64 | 4.59 | 14.23 | 11.66 | 32.13 | 44.39 |
| $CS_4$ - Soybean-onion | 99.87 | 16.16 | 116.03 | 8.80 | 4.72 | 13.52 | 11.65 | 35.95 | 47.60 |
| SEm± | 1.90 | 0.78 | 2.34 | 0.34 | 0.13 | 0.40 | 0.15 | 1.41 | 1.17 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| N X C | NS | NS | NS | NS | NS | NS | NS | NS | NS |

## References


1. Anonymous, http://www.sopa.org/statistics/soybean-production, 2018.
2. Anonymous, Foreign Agricultural Service/USDA Office of Global Analysis, 2019.
3. Ansari AA, Sukhraj K. Effect of vermiwash and vermicompost on soil parameters and productivity of okra (*Abelmoschus esculentus*) in Guyana. African Journal of Agricultural Research. 2010; 5(14):1794-1798.
4. Arbad BK, Ismail S. Effect of integrated nutrient management on soybean (*Glycine max* L.)-safflower (*Carthamus tinctorius*) cropping system. Indian Journal of Agronomy. 2011; 56(4): 340-345.
5. Canellas LP, Olivares FL, Okorokova-Fac¸ anha AL, Fac anha AR. Humic acids isolated from earthworm compost enhance root elongation, lateral root emergence, and plasma membrane H+-ATPase activity in maize roots. Plant Physiology, 2002; 130:1951-1957.
6. Haldankar CB, Raut VM, Taware SP, Patil VP. Production component study in soybean. Journal of Maharashtra Agricultural Universities. 1992; 33(1-4):101-117.
7. Rose E, Rarthes B, Martias C, Tiessen H, Vledk PLG. Organic matter management for soil conservation and productivity restoration in Abrica, special assure managing organic matter in tropical soils; scope and limitations. Proceeding of a workshop organized by the center of development research Univ. Bonn. Germany. 7-10 June 1999. Nutri. Cycl Agro-ecosys. 2001; 61(12):159-170.
8. Tiwari A, Dwivedi AK, Dikshit PR. Long term influence of organic and inorganic fertilization on soil fertility and productivity of soybeanwheat system in Vertisol. Journal of Indian Society of Soil Science. 2002; 50(4):472-475.
9. Vahanka, P. M., Chawada, C. B. and Dubey, R. Cow urine as biofertilizer–case studies. Baif-Griserv Office Vadodara, published online. 2010.