Biological Forum – An International Journal **15(2): 409-413(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Nutrient Uptake and Growth parameters of Isabgol Influenced under different organic manures and bio-nutrients

Sanjay Kumar[1]*, R.N. Meena[2], Gharsiram[3] and Pradeep Kumar[4]

[1]Research Scholar, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (Uttar Pradesh), India.

[2]Associate Professor, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (Uttar Pradesh), India.

[3]Research Scholar Department of Agronomy, Junagadh Agricultural University, Junagadh (Gujarat), India.

[4]Research Scholar Department of Agronomy, Navsari Agricultural University, Navsari (Gujarat), India.

(Corresponding author: Sanjay Kumar)*

(Received: 28 December 2022; Revised: 05 February 2023; Accepted: 09 February 2023; Published: 14 February 2023)

(Published by Research Trend)

ABSTRACT: To increase yield of higher-quality medicinal plants and aromatic herbs, organic manures and biostimulants can be employed. Successful management of organic fertiliser is essential for growing medicinal and fragrant plants. Utilizing chemical fertilisers sparingly and mixing organic manures with bio-fertilizers in the soil enhances soil fertility and is thought to promote the vegetative growth and development of plants as well as the development of their productive and commercial portions. In this way, organic fertilisers will improve soil structure, water holding capacity, microbial activity, and nutrient availability without adversely affecting the ecosystem. In the above mentioned scenario, a research experiment was examined to study the impact of organic manures and bionutrients on nutrient removal and growth of isabgol during two consecutive *rabi* seasons of 2020 and 2021, respectively. The research work was laid out in split plot design with five treatment of organic manures in main plot and four treatment of bio-nutrients in sub plots. Main plots comprising of M_1 (Control), M_2 (100 % RDN through FYM), M_3 (100 % RDN through Vermicompost), M_4 (100 % RDN through Poultry manure) and M_5 (100 % RDN through Goat manure) and sub plot treatments comprising *i.e.* Bio-nutrients S_1 (control), S_2 (Azotobactor + PSB), S_3 (Jivamrut) and S_4 (Azotobactor + PSB + Jivamrut). The results revealed that higher growth and nutrient uptake with 100 % RDN through FYM. Among the bio-nutrients, Azotobactor + PSB + Jivamrut recorded significantly higher growth and nutrient uptake during both the years.

Keywords: Isabgol, azotobacter, bionutrients, yield, poultry manure.

INTRODUCTION

Isabgol (*Plantago ovata* forsk.), an annual stemless medicinal plant that has been widely used for its medical benefits around the world, South Asia has used it as a medicine for many ages. Today, it goes by the name "Dollar earner" in South Western Rajasthan and North Gujarat. Currently Gujarat, Rajasthan, Madhya Pradesh and Haryana are the only states in India involved in isabgol production, around 60,000 ha area under isabgol production brought together by the states Gujarat and Rajasthan Isabgol is raised under irrigated conditions as a *rabi* season crop and grown in all types of soil but performs best on loamy soil (Qureshi and Dewangan 2022). About 80% of the psyllium (Isabgol) supplied on the international market comes from India. India is the world's leading producer of isabgol, and the country exports seed and husk for $25 million each year. The proper use of nutrient inputs can lead to sustainable agriculture since, as we all know, nutrients play a crucial role in enhancing agricultural production.Over and imbalance fertilization costs poor soil quality and thereby decreases productivity. Therefore, any substitute methods for N nutrition must be proposed in order to preserve soil fertility and high levels of productivity. In this regard, integrated nutrient management—the use of organic and biofertilizers alongside chemical fertilizers—is stressed, particularly in the cultivation of medicinal plants due to the steadily rising demand for organically grown herbs. Alternative inputs, such as organic manure and compost, may be more suitable for growing such medicinal herbs. Recently, organically grown medicinal herbs have received more attention and fetch a premium price in the international market. Considering the enriched organic fertilizer may have promising potential for quality isabgol production by avoiding the use of costly chemical fertilizers (Basak and Ajoy 2022). Without negatively affecting the environment, the use of organic amendments has been recognized generally as an effective means for improving soil aggregation, structure and fertility, increasing microbial diversity and populations, improving the moisture-holding capacity of soils, increasing the soil cation exchange capacity (CEC) that is why it is played direct role in

increasing crop yields (Rautaray *et al.,* 2019, Azarmi *et al*. 2008). Organic manures such as FYM, vermicompost, sunnhemp, castor cake, neem cake and sunhemp as in-situ green manure application on cotton yield and quality (Manchala *et al.,* 2017). Foliar spray of panchagavya on growth and yield of *Amaranthus viride*, experimental results indicated that foliar spray of panchgavya @ 3% recorded significantly higher plant height, number of leaves and leaf area index and green leaf yield (Venkatalakshmi *et al.,* 2009). Manjunatha *et al.* (2009) observed that incorporation of FYM treated with jivamrut significantly increased gross returns and B:C ratio in sunflower. Phosphorus plays beneficial role in the root development, nodulation and stimulation of the symbiotic nitrogen fixation. In presence of phosphorus, bacterial cell become mobile, which is a pre requisite for migration of bacteria to root hair for nodulation. Phosphorus Solubilising Bacteria (PSB) and phosphate solubilising microorganisms, particularly the soil bacteria belonging to the genera Pseudomonas and Bacillus, possess ability to transform insoluble phosphates into soluble forms (Mor *et al.* 2014). Little scientific information is available on the influence of organic manures and bio-nutrients on growth, nutrient content and uptake of Isabgol in Varanasi conditions. Therefore, it is important to evaluate organic N management with various biofertilizers for a better understanding of narrow down the use of nitrogenous fertilizers with improved crop growth and better removal of nutrient by Isabgol crop.

MATERIAL AND METHODS

A research work was examined at Agricultural Research farm (25°18' North latitude and 83°03' E), Banaras Hindu University, Varanasi in split plot design assigning five Organic manures in main plot comprising of M_1 (Control), M_2 (100 % RDN through FYM), M_3 (100 % RDN through Vermicompost), M_4 (100 % RDN through Poultry manure) and M_5 (100 % RDN through Goat manure) and treatments of sub plot comprising *i.e*. Bio-nutrients N_1 (control), N_2 (Azotobactor + PSB), N_3 (Jivamrut) and N_4 (Azotobactor + PSB + Jivamrut). A total of 20 treatments combinations were replicated thrice and were examined for the study. Organic manures were collected IFS and dairy farm belonging to Krishi farm, Banaras Hindu University at Varanasi, Uttar Pradesh. While, Jivamrut, it was prepared at IFS, Krishi farm and biofertilizers collected from KVK Durgapura, Jaipur. Organic manure was manually incorporated in the experimental plot at one week before sowing and Jivamrut was applied at the time of irrigation while, seeds treated with biofertilizer at the time of sowing. Recommended dose of Nitrogen, phosphorous and potassium (50-25-25 kg ha^{-1}) respectively were applied through Urea, SSP and MOP. Variety GI-2 of Isabgol was taken for the study. Two seeds per hill sown at spacing of 30 cm × 10 cm on 1st December and 1st December of 2020 and 2021 respectively. The total rainfall 1635.90 mm in 2020-21 and 1167.4 mm in 2021-22 was experienced during the crop growth season. Irrigation was provided as and when required. Other crop management practices were followed as per standard recommendations.

Nutrient uptake in grain and straw of Isabgol crop for N, P and K was calculated by using following formula and expressed in kg ha^{-1}

Nutrient uptake (kg ha^{-1}) =

$$\frac{\text{Nutrient content (\%)} \times \text{Dry matter (Kg ha}^{-1})}{100}$$

The data for each character were analysed using the analysis of variance approach, and the "F" test was used to determine whether the results were significant. (Gomez and Gomez 1984).

RESULTS AND DISCUSSIONS

Organic manures and Bionutrients exerted significant effect on growth, Nutrient uptake of Isabgol. Significantly higher plant height (33.14 cm), No. of leaves $plant^{-1}$ (28.05 and 31.03), No. of branches $plant^{-1}$ (4.63), chlorophyll SPAD value (31.01 and 31.83), No. of tillers $plant^{-1}$ (6.23 and 6.36) and Dry matter (g) meter row $length^{-1}$ (57.75 and 59.77q ha^{-1}) were recorded under 100% RDN through Poultry manure, while all these parameters were found statistically at par with 100% RDN through Vermicompost and 100% RDN through Goat manure during both the year (Table 1 and 2). Vermicomposting seems to hold the most promise as high-value biofertilizers that boost production by supplying nutrients while also promoting plant development and Crop productivity is reported to increase as a result of the increased mineralization of nutrients (Amir and Fouzia 2011). Organic manures has helped the plants by better utilization of stored carbohydrates, nitrogen and other factors. Findings of Jayathilake *et al.* (2003); Aher and Khapke (2009) strongly support the results obtained from the present study.

Among the Bionutrients, S_4 (Azotobactor + PSB + Jivamrut) recorded significantly higher plant height (33.94 cm), No. of leaves $plant^{-1}$ (27.82 and 31.02), No. of branches $plant^{-1}$ (4.33), chlorophyll SPAD value (30.08 and 30.33), No. of tillers $plant^{-1}$ (5.97 and 6.10) and Dry matter (g) meter row $length^{-1}$ (58.06 and 58.28 q ha^{-1}) during *rabi*, 2020 and 2021, respectively. However, almost all these parameters were found statistically at par with treatment S_3 (Jivamrut). While, No. of flowers $plant^{-1}$ did not meet the level of significance during both the years under organic manures and bionutrients. A liquid organic solution called jivamrut is made from cow dung, urine, bean flour, and jaggary. The macronutrients, important micronutrients, numerous vitamins, necessary amino acids, growth-promoting substances including IAA and GA, and beneficial microbes are all present in bionutrients like jivamrut (Palekar, 2006; Natarajan, 2007; Sreenivasa *et al.,* 2010). PSB and Azotobacter are key players in N fixation. Additionally, they provide growth-promoting compounds such cytokinins, gibberellins, and indole acetic acid (Barea and Brown 1974; Pareek *et al.,* 1996). Umamaheswari and Vijayalakshmi (2014) concluded that, the use of jeevamruth as a soil enriching manure is both farmer

friendly and capable to produce higher yield of good quality.

Nutrient uptake for Nitrogen, phosphorous and potassium by Isabgol crop were influenced significantly with imposed treatments (Table 3). 100% RDN through Poultry manurenoted significantly higher nitrogen uptake (46.84 & 49.26), phosphorus uptake (18.00 & 19.84)and potassium uptake (32.89 & 35.65). However, these all nutrient uptake were found statistically at par with 100% RDN through Vermicompost and 100% RDN through Goat manure during both the year. The present study collaborated with Ranjith (2015) reported in Tomato. A similar result with vermicompost was reported by Ravimycin (2016) and also Shinde and Sontake (1993) reported higher phosphorus content in vermicompost over farmyard manure (FYM).

Treatment S_4 (Azotobactor + PSB + Jivamrut) achieved significantly higher nitrogen uptake (46.44 & 50.94), phosphorus uptake (17.68 & 19.39) and potassium uptake (32.32 & 34.72) over rest of the bionutrient levels. However, potassium uptake (30.86 & 33.08) was found statistically at par with treatment S_3 (Jivamrut) during *rabi*, 2020 and 2021, respectively. This might be due to good improvements of root as well as their functional activity resulting in extraction of good amount of major and micro nutrients from soil environment and aerial parts (Koyani *et al.,* 2012). Nutrients such as N, P, and K which readily available through poultry manure and vermicompost, helping in the chlorophyll and pigments formation which is required for light harvesting and subsequent conversion light energy into chemical energy via photo-assimilation (Tanaka *et al.,* 1998).

Table 1: Effect of organic manures and Bio-nutrients on plant height, tillers plant^{-1}, branches plant^{-1}and Dry matter (g) meter row length^{-1} of Isabgol at harvest.

Treatments	Plant height (cm)		Tillers plant^{-1}		Branches plant^{-1}		DMA (g) meter row length^{-1}	
	2020	2021	2020	2021	2020	2021	2020	2021
A. Main plot : Organic manures								
M_1: Control	28.85	29.23	3.80	3.93	3.22	3.46	49.05	48.20
M_2: 100% RDN through FYM	29.74	30.13	4.26	4.31	3.37	3.59	53.59	52.95
M_3: 100% RDN through Vermicompost	31.28	31.51	6.02	6.15	3.65	3.88	57.05	56.39
M_4: 100% RDN through Poultry manure	33.14	32.39	6.23	6.36	3.68	4.63	57.75	59.77
M_5: 100% RDN through Goat manure	30.76	31.09	5.82	5.95	3.61	3.69	55.62	55.82
SEm±	0.75	0.64	0.35	0.32	0.17	0.22	1.21	1.34
LSD (p=0.05)	2.43	NS	1.14	1.04	NS	0.71	3.95	4.38
B. Sub plot : Bionutrients								
S_1: Control	29.77	29.64	4.04	4.17	3.24	3.31	50.73	49.24
S_2: Azotobacter + PSB	30.49	30.89	5.46	5.52	3.44	3.73	54.28	54.98
S_3: Jivamrut	31.03	31.00	5.44	5.57	3.66	4.03	55.38	56.01
S_4: Azotobacter + PSB + Jivamrut	31.72	31.94	5.97	6.10	3.68	4.33	58.06	58.28
SEm±	0.55	0.44	0.21	0.17	0.14	0.16	0.99	1.16
LSD (p=0.05)	NS	1.27	0.61	0.48	NS	0.47	2.87	3.35
Interaction (M × N)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 2: Effect of organic manures and Bio-nutrients on No. of leaves plant^{-1}, SPAD value and No. of flowers plant^{-1} of Isabgol crop at 90 Days after sowing.

Treatments	No. of leaves plant^{-1}		SPAD value		No. of flowers plant^{-1}	
	2020	2021	2020	2021	2020	2021
A. Main plot : Organic manures **M_1**: Control	26.34	26.65	26.34	26.65	43.95	46.27
M_2: 100% RDN through FYM	27.08	27.15	27.08	27.15	47.30	50.39
M_3: 100% RDN through Vermicompost	28.60	28.76	28.60	28.76	47.76	49.81
M_4: 100% RDN through Poultry manure	31.01	31.83	31.01	31.83	49.45	51.66
M_5: 100% RDN through Goat manure	27.40	28.06	27.40	28.06	47.73	49.71
SEm±	0.71	0.75	0.71	0.75	1.94	2.19
LSD (p=0.05)	2.30	2.46	2.30	2.46	NS	NS
B. Sub plot : Bionutrients **S_1**: Control	25.45	25.66	25.45	25.66	43.91	46.21
S_2: Azotobacter + PSB	27.78	28.21	27.78	28.21	46.49	48.76
S_3: Jivamrut	29.03	29.76	29.03	29.76	48.46	50.58
S_4: Azotobacter + PSB + Jivamrut	30.08	30.33	30.08	30.33	50.10	52.72
SEm±	0.72	0.72	0.72	0.72	1.72	2.03
LSD (p=0.05)	2.07	2.08	2.07	2.08	NS	NS
Interaction (M × N)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 3: Effect of organic manures and Bio-nutrients on Nutrient uptake of Isabgol crop.

Treatments	N uptake		P uptake		K uptake	
	2020	2021	2020	2021	2020	2021
A. Main plot : Organic manures M_1:Control	37.03	36.76	13.94	14.69	25.69	28.30
M_2:100% RDN through FYM	41.02	41.15	15.66	16.62	28.25	30.95
M_3:100% RDN through Vermicompost	44.61	51.02	16.81	18.64	31.01	32.64
M_4:100% RDN through Poultry manure	46.84	49.26	18.00	19.84	32.89	35.65
M_5:100% RDN through Goat manure	44.03	46.77	16.29	18.62	30.83	32.13
SEm±	1.22	1.32	0.38	0.45	1.17	1.24
LSD (p=0.05)	3.97	4.30	1.25	1.47	3.81	4.04
B. Sub plot : Bionutrients S_1: Control	36.39	38.06	13.68	15.06	25.89	28.14
S_2: Azotobacter + PSB	43.54	43.86	16.38	17.80	29.86	31.79
S_3: Jivamrut	44.23	47.10	16.81	18.48	30.86	33.08
S_4: Azotobacter + PSB + Jivamrut	46.66	50.94	17.68	19.39	32.32	34.72
SEm±	0.61	0.98	0.23	0.24	0.54	0.59
LSD (p=0.05)	1.76	2.83	0.65	0.70	1.56	1.70
Interaction (M × N)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

CONCLUSIONS

From the above mentioned study, it is recommended that to obtain higher plant growth as well as better uptake of nutrient of Isabgol crop should be grown by 100% RDN through Poultry manurealong with Azotobactor + PSB + Jivamrut.

FUTURE SCOPE

According to given by this conclusion, we can make agriculture for ecological sound and we can decreases the dependency on chemical fertilizer.

Acknowledgement. The authors wish to thank Department of Agronomy, University of Banaras Hindu University Varanasi (UP) for creating an enabling environment for this research work.
Conflict of Interest. None.

REFERENCES

Aher, R. K. and Khapke, S. L. (2009). Comparative study of chemical and biofertilizers on growth and yield of methi (*Trigonella foenum-graceum* L.). *International Journal of Agriculture and Crop Sciences, 4*, 1-112.

Amir Khan and Fouzia Ishaq (2011). Chemical analysis of different composts (Vermicompost and Pitcompost) and their effect on the growth of *Pisum sativum*. *Asian Journal of plant science and research, 1*(1), 116-130.

Azarmi, R., Giglou, M. T. and Taleshmikail, R. D. (2008). Influence of vermicompost on soil chemical and physical properties in tomato (*Lycopersicum esculentum*) field. *African Journal of Biotechnology, 7*, 14, 2397-2401.

Barea, J. M. and Brown, M. E. (1974). Effect on plant growth produced by *Azotobacter paspali* related to synthesis of plant growth regulating substances. *Journal of Application Bact., 37*, 583-593.

Basak, B. B. and Ajoy, S. A. H. A. (2022). Recycling of isabgol (*Plantago ovate* Forsk) straw biomass and mineral powder with bio-inoculants as an effective soil amendment for isabgol cultivation. *Pedosphere*.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural research (2 ed.), John wiley and sons, New York.

Koyani, C. R., Chovatia, P. K. and Gohil, B. S. (2012). Effect of nitrogen and phosphorus on growth, yield attributes and yield of rabi fennel (*Foeniculum vulgare* Mill.). Agriculture: Towards a New Paradigm of Sustainability.

Manchala, Santhosh Kumar, Bhoyar, S. M., Deshmukh, P. W., Sathyanarayana, E. and Leena Dajurao Kgrangami (2017). Yield and quality of rainfed cotton in response to organic manures under vertisol. *Plant Archives*. *17*(1), 412-416.

Manjunatha, G. S., Upperi, S. N., Pujari, B. T., Yeledahalli, N. A. and Kuligod, V. B. (2009). Effect of farm yard manure treated with jivamrut on yield attributes, yield and economics of sunflower (*Helianthus annuus* L.). *Karnataka Journal of Agricultural Sciences, 22*(1), 198-199.

Mor, V. B., Patel, J. J., Chaudhary, A. N., Chaudhari, M. G. and Chaudhary, R. F. (2014). Influence of Different Sources and Levels of Phosphorus and Biofertilizer (PSB) on Yields, Quality, NPK Content and Economics of Isabgol (*Plantago ovate* Forsk). *Trends in Biosciences*, *7*(22), 3750-3753.

Natarajan, K. (2007). Panchagavya for plant. Proc. Nation. Conf. Glory Gomatha, Dec. 1-3, 2007. Sri Venkateshwara Veterinary University, Tirupati, 72-75.

Palekar, S. (2006). Text book on shoonya bandovalada naisargika krushi, published by swamy anand. *Agri Prakashana, Bangalore*, *67*.

Pareek, S. K, Srivastava, V. K. Maheshwari, M. L. and Gupta, R. (1996). Effect of and zinc levels on yield of coriander. *Annals of Horticulture, 2*(2), 230-231.

Qureshi, S. A. and Dewangan, Y. K. (2022). Impact of different nutrient management practices on growth dynamics, husk and seed yield of isabgol (*Plantago ovata*).

Ranjit Chatterjee (2015). Influence of nutrient sources on growth, yield and economics of organic lettuce production under foothills of eastern Himalayan region Emirates. *Journal of Food and Agriculture, 27*(5), 460-462.

Rautaray, S. K., Pradhan, S., Mohanty, S., Dubey, R., Raychaudhuri, S., Mohanty, R. K., Mishra, A. and Ambast, S. K. (2019). Energy efficiency, productivity and profitability of rice farming using Sesbania as green manure-cum-cover crop. *Nutri. Cycling Agroeco.*, *116,* 83-101.

Ravimycin, T. (2016). Effects of vermicompost (VC) and farmyard manure (FYM) on the germination percentage growth biochemical and nutrient content of coriander (*Coriandrum sativum* L.). *International Journal of Advances Research Biological Science, 3*(6), 91-98.

Shinde, M. N. and Sontake, M. B. (1993). Bulb crops In: Vegetable Crops (Ed. T.K. Bose, M.G. Som and J.

Kabir) revised edition. Naya Prakashan, Calcutta, pp. 641-685.

Sreenivasa, M. N., Nagaraj M. Naik and Bhat, S. N. (2010). Beneficial traits of microbial isolates of organic liquid manures. Proc. First Asian PGPR Congress for Sustainable Agriculture, Hyderabad.

Tanak, A., Ito, H., Tanaka, N. K., Yoshida, K. and Okada, K. (1998). Chlorophyll a oxygenase (CAO) is involved in chlorophyll b formation from chlorophyll a. Proc National Academy Scki. *USA. 95*, 12719-12723.

Umamaheswari, S. and Vijayalakshmi, G. S. (2003). Vermicomposting of paper misssuludge using an African earthworm species *Eudrilus eugeniae* Kinberg with a note on its physiochemical features. *Pollution Research. 22*, 339-341.

Venkatalakshmi, K., Balasubramanian, A. and Sankaran, N. (2009). Influence of seed treatment and foliar spray of panchgavya on growth, yield attributes and yield of X *Amaranthus viride*. *Madras Agriculture Journal, 96*(1-6), 135-138.

How to cite this article: Sanjay Kumar, R.N. Meena, Gharsiram and Pradeep Kumar (2023). Nutrient Uptake and Growth parameters of Isabgol Influenced under different organic manures and bio-nutrients. *Biological Forum – An International Journal, 15*(2): 409-413.