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Effect of different integrated nutrient sources on growth, herbage and pod yield of Senna crop (*Cassia angustifolia* Vahl.)

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Abstract

The present investigation was conducted to evaluate the “Effect of integrated nutrient management practices on growth, herbage and pod yield of Senna crop (*Cassia angustifolia* Vahl.)”. In experiment eight treatments of different inorganic, organic and natural nutrient management combinations with three replications in Randomized block design (RBD). Among the treatments growth parameters of senna viz. plant height and number of branches was significantly increased with the application of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ as compared to other nutrients combinations. As regards to yield attributes and yield, application of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ produces highest yield attributes like number of pods plant⁻¹ and number of leaves plant⁻¹. Thus, increase in yield attributes results in increased yield of senna crop. The increase in fresh leaf yield, dry leaf yield, fresh pod yield and dry pod yield of senna observed more significantly with the application of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹.

Keywords: Integrated nutrient management, FYM

Introduction

Cassia angustifolia Vahl., commonly known as Senna, is an important medicinal plant belonging to the family Fabaceae and is widely valued for its therapeutic significance. The term “Senna” is derived from the Arabic word “Sana,” meaning medicinal herb. It is a small perennial under-shrub with pinnate leaves and yellow flowers, extensively cultivated for its leaves and pods which constitute the main economic parts of the plant. The crop is well adapted to tropical and subtropical regions, flourishing in arid and semi-arid climates on light to medium soils with low fertility. Though believed to have originated in Arabia and Sudan, India is recognized as one of the leading centers of its cultivation, with major growing areas concentrated in Tamil Nadu and Rajasthan, covering approximately 20,000 ha. The dried leaves and pods of senna are rich in anthraquinone glycosides, particularly sennosides A and B, which impart strong purgative properties and form the basis for its wide pharmaceutical utility. In addition to its laxative action, senna possesses antimicrobial, antifungal, and blood-purifying properties, making it an important crop in both traditional medicine and modern pharmacology. It has long been employed in the treatment of constipation, skin disorders, helminthic infections, and for detoxification purposes. The crop matures within 90–110 days of sowing, and subsequent harvests can be taken at intervals of 60–70 days depending on environmental conditions. Adoption of integrated nutrient management practices, which combine the judicious use of organic manures with inorganic fertilizers, is critical to sustaining soil fertility and enhancing yield potential of senna, thereby ensuring its economic and medicinal importance across diverse agro-climatic zones. Organic farming improves soil organic carbon, accessible nutrient content, microbial population and enzymatic activity, making it more sustainable for organic crop production (Dahiphale *et al.*, 2003) ^[1]. Adding different organic origin nutrients in the soil such as organic manure, bio-fertilizer and FYM will be effective in further improving productivity sustainably. *Ghanjeevamrit* and *jeevamrit* indigenous components/supplements have a greater

load of microorganisms, which helps in the mineralization of essential macro and micronutrients elements that aid in plant availability and uptake. These formulations are incredibly rich in microorganisms that proliferate in the soil easily and help in boosting the microbial processes and their activity (Palekar S., 2006)^[6].

Materials and Methods

A field experiment was conducted during *rabi* season 2024-25 at university farm, Raipur (C.G.) Indira Gandhi Krishi Vishwavidyalaya. The soil was slightly acidic in nature with low available nitrogen content, high phosphorus content and higher level of potassium. In experiment eight treatments of different integrated nutrient management combinations that's are T₁: Control, T₂: 100% N: P₂O₅:K₂O @ 80:40:20 kg ha⁻¹, T₃: 100% FYM @ 12.5ton ha⁻¹ + *Azotobacter* @ 1.5 kg ha⁻¹ + *Phosphobacter* @ 2 kg ha⁻¹, T₄: 75% N:P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹, T₅: 50% N: P₂O₅:K₂O @ 40:20:10 kg ha⁻¹ + 50% FYM @ 6.25ton ha⁻¹, T₆: *Ghanjeevamrit* @ 1000kg ha⁻¹ + *Jeevamrit* @ 500 litres ha⁻¹ at 15 D.I., T₇: *Ghanjeevamrit* @ 1500kg ha⁻¹ + *Jeevamrit* @ 1000 litres ha⁻¹ at 15 D.I., T₈: 33% N: P₂O₅:K₂O @ 26.4:13.2:6.6 kg ha⁻¹ + 33% FYM @ 4.125 ton ha⁻¹ + 33% *Jeevamrit* @ 330 litres ha⁻¹ at 15 D.I. after sowing. Senna variety ALFT-2 is the variety of Anand, Gujarat is taken as a test crop. It is a late flowering, higher foliage and long duration (180-185 days) variety. The test crop was sown on 1st November 2024 at 45 x 30 cm. Recommended dose of nutrients like N: P₂O₅:K₂O, FYM and *ghanjeevamrit* as basal application was applied at a time of sowing. Foliar spray of *jeevamrit* at sowing, 30, 45 and 60 DAS. The crop was harvested 2 times (at 120 DAS & at 180 DAS) at maturity as per schedule. The data for growth attributes: Plant height (cm) and No. of branches plant⁻¹ were recorded at different stage of growth at 30, 60, 90, 120, 150 and 180 DAS. The yield of both the harvest were added from different yield attributes data. These parameters were statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized block design.

Results and Discussion

Growth attributes

The plant height was increased with the progress in the crop age. The plant height significantly varied due to different levels of various integrated nutrient sources from beginning to till harvest. Among the different levels of nutrient sources application of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ (T₄) treatment was recorded significantly highest plant height, however it was comparable with 100% N: P₂O₅:K₂O @ 80:40:20 kg ha⁻¹ (T₂), 50% N:P₂O₅:K₂O @ 40:20:10 kg ha⁻¹ +

50% FYM @ 6.25ton ha⁻¹ (T₅), 33% N:P₂O₅:K₂O @ 26.4:13.2:6.6 kg ha⁻¹ + 33% FYM @ 4.125 ton ha⁻¹ + 33% *Jeevamrit* @ 330 litre ha⁻¹ at 15 D.I. (T₈). On the other hand, lowest plant height observed under control (T₁). Senna plant height increased progressively with advancing crop age and was significantly influenced by various integrated nutrient management regimes by Muruganandam *et al.* (2022)^[5]. Application of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ (T₄) significantly recorded highest number of branches plant⁻¹ which was at par with 100% N: P₂O₅:K₂O @ 80:40:20 kg ha⁻¹ (T₂), 50% N:P₂O₅:K₂O @ 40:20:10 kg ha⁻¹ + 50% FYM @ 6.25ton ha⁻¹ (T₅). The significant increase in the number of branches per plant under integrated nutrient management could be attributed to the steady supply of nitrogen and other essential nutrients, ensuring continuous vegetative growth. Similar improvements in branching of senna under combined application of organic and inorganic nutrient sources were also reported by Senthilkumar *et al.* (2003)^[7] and Kayina (2011)^[2].

Yield attributes

The fresh and dry leaf yield significantly the highest were recorded under 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ (T₄) which was comparable with 100% N: P₂O₅:K₂O @ 80:40:20 kg ha⁻¹ (T₂), 50% N:P₂O₅:K₂O @ 40:20:10 kg ha⁻¹ + 50% FYM @ 6.25ton ha⁻¹ (T₅). The increase in fresh and dry leaf yield has also been reported by Kumar *et al.* (2018)^[3], who observed that integrated use of organic and inorganic nutrient sources enhanced leaf biomass and yield in senna. Different nutrient management also exhibited marked differences in fresh and dry pod yield. Among the integrated nutrient management treatments 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ (T₄) different integrated nutrient management significantly influenced the number of pods plant⁻¹ and number of leaves plant⁻¹ of senna. The highest fresh and dry pod yield was recorded with a combined use of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹. Integrated nutrient management exhibited significant variations in the leaf and pod yield. The performance of 75% N: P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ (T₄) (3939.97) was significantly superior over other treatments in terms of leaf yield and was found at par with 100% N: P₂O₅:K₂O @ 80:40:20 kg ha⁻¹ (T₂) (3884.43 kg ha⁻¹) and 50% N:P₂O₅:K₂O @ 40:20:10 kg ha⁻¹ + 50% FYM @ 6.25ton ha⁻¹ (T₅) (3814.14 kg ha⁻¹). Senna plants producing a greater number of branches per plant, more leaves per plant, and heavier pod weight contributed to higher leaf and pod yields-findings consistent with the results reported by Kumar, Jnanasha, and Bharath Kumar (2018)^[3].

Table 1: Plant height (cm) and Number of branches plant⁻¹ of senna as influenced by various integrated nutrient management practices at various stages of the crop

Treatment	Plant height (cm)						Number of branches plant ⁻¹					
	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS	30 DAS	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS
T ₁ : Control	9.41	12.23	18.46	30.75	35.08	56.52	3.30	4.77	7.67	10.27	12.30	13.50
T ₂ : 100% N: P ₂ O ₅ :K ₂ O @ 80:40:20 kg ha ⁻¹	18.47	25.74	38.34	58.07	70.08	93.17	4.87	7.33	11.17	13.00	15.07	16.37
T ₃ : 100% FYM @ 12.5ton ha ⁻¹ + <i>Azotobacter</i> @ 1.5 kg ha ⁻¹ + <i>Phosphobacter</i> @ 2 kg ha ⁻¹	15.23	19.13	28.41	44.31	53.21	75.43	4.10	6.40	10.20	11.60	13.67	14.83
T ₄ : 75% N:P ₂ O ₅ : K ₂ O @ 60:30:15kg ha ⁻¹ + 25% FYM @ 3.125ton ha ⁻¹	19.66	27.02	41.32	61.94	73.53	96.06	4.97	7.50	11.30	13.20	15.37	16.63
T ₅ : 50% N:P ₂ O ₅ :K ₂ O @ 40:20:10 kg ha ⁻¹ + 50% FYM @ 6.25ton ha ⁻¹	16.67	22.47	34.97	53.90	65.97	87.41	4.33	7.13	10.87	12.37	14.47	15.83
T ₆ : <i>Ghanjeevamrit</i> @ 1000kg ha ⁻¹ + <i>Jeevamrit</i> @ 500 litre ha ⁻¹ at 15 D.I.	12.73	16.02	21.25	35.11	40.78	65.67	3.60	5.73	9.40	11.23	12.70	13.53
T ₇ : <i>Ghanjeevamrit</i> @ 1500kg ha ⁻¹ + <i>Jeevamrit</i>	13.70	18.36	25.83	40.55	48.31	70.70	3.80	6.20	9.80	11.57	13.27	14.23

@1000 litre ha ⁻¹ at 15 D.I.												
T ₈ : 33% N:P ₂ O ₅ :K ₂ O @ 26.4:13.2:6.6 kg ha ⁻¹ + 33% FYM @ 4.125 ton ha ⁻¹ + 33% Jeevamrit @ 330 litre ha ⁻¹ at 15 D.I.	16.83	20.89	31.26	49.64	59.90	82.00	4.20	6.47	10.47	12.07	14.00	15.20
S.Em±	3.52	0.66	1.43	1.13	5.08	2.23	0.76	0.1	0.06	0.07	0.03	0.32
CD(P=0.05)	NS	2.00	4.34	3.43	15.40	6.77	NS	0.31	0.2	0.22	0.08	0.96

Table 2: Number of pods plant⁻¹ and number of leaves plant⁻¹ of senna as influenced by various integrated nutrient management practices at various stages of the crop

Treatment	No. of pods plant ⁻¹		No. of leaves plant ⁻¹	
	1 st harvest	2 nd harvest	1 st harvest	2 nd harvest
T ₁ : Control	25.6	23.0	195.3	327.3
T ₂ : 100% N: P ₂ O ₅ :K ₂ O @ 80:40:20 kg ha ⁻¹	64.0	59.3	375.0	577.0
T ₃ : 100% FYM @12.5ton ha ⁻¹ + Azotobacter @1.5 kg ha ⁻¹ + Phosphobacter @ 2 kg ha ⁻¹ .	49.0	47.0	286.0	425.3
T ₄ : 75% N:P ₂ O ₅ : K ₂ O @ 60:30:15kg ha ⁻¹ + 25% FYM @ 3.125ton ha ⁻¹	65.0	62.3	386.0	592.0
T ₅ : 50% N:P ₂ O ₅ :K ₂ O @ 40:20:10 kg ha ⁻¹ + 50% FYM @ 6.25ton ha ⁻¹	62.6	57.3	355.9	500.0
T ₆ : Ghanjeevamrit @ 1000kg ha ⁻¹ + Jeevamrit @ 500 litre ha ⁻¹ at 15 D.I.	35.6	33.0	214.0	371.6
T ₇ : Ghanjeevamrit @ 1500kg ha ⁻¹ + Jeevamrit @1000 litre ha ⁻¹ at 15 D.I.	45.0	43.0	274.0	412.0
T ₈ : 33% N:P ₂ O ₅ :K ₂ O @ 26.4:13.2:6.6 kg ha ⁻¹ + 33% FYM @ 4.125 ton ha ⁻¹ + 33% Jeevamrit @ 330 litre ha ⁻¹ at 15 D.I.	52.6	50.6	323.0	474.3
S.Em±	1.07	1.17	10.41	2.94
CD (P=0.05)	3.25	3.54	31.59	8.91

Table 3: Fresh leaf yield (kg ha⁻¹), Dry leaf yield (kg ha⁻¹), Fresh pod yield (kg ha⁻¹) and Dry pod yield (kg ha⁻¹) of senna as influenced by various integrated nutrient management practices at various stages of the crop

Treatment	Fresh leaf yield (kg ha ⁻¹)	Dry leaf yield (kg ha ⁻¹)	Fresh pod yield (kg ha ⁻¹)	Dry pod yield (kg ha ⁻¹)
T ₁ : Control	1399.06	576.80	703.62	200.40
T ₂ : 100% N: P ₂ O ₅ :K ₂ O @ 80:40:20 kg ha ⁻¹	3884.43	1163.07	1936.70	511.46
T ₃ : 100% FYM @12.5ton ha ⁻¹ + Azotobacter @1.5 kg ha ⁻¹ + Phosphobacter @ 2 kg ha ⁻¹	2794.57	921.42	1372.25	357.20
T ₄ : 75% N:P ₂ O ₅ : K ₂ O @ 60:30:15kg ha ⁻¹ + 25% FYM @ 3.125ton ha ⁻¹	3939.97	1202.22	1994.59	531.30
T ₅ : 50% N:P ₂ O ₅ :K ₂ O @ 40:20:10 kg ha ⁻¹ + 50% FYM @ 6.25ton ha ⁻¹	3814.14	1118.87	1729.86	489.13
T ₆ : Ghanjeevamrit @ 1000kg ha ⁻¹ + Jeevamrit @ 500 litre ha ⁻¹ at 15 D.I.	2182.58	741.00	883.08	237.98
T ₇ : Ghanjeevamrit @ 1500kg ha ⁻¹ + Jeevamrit @1000 litre ha ⁻¹ at 15 D.I.	2563.23	868.88	1206.70	320.56
T ₈ : 33% N:P ₂ O ₅ :K ₂ O @ 26.4:13.2:6.6 kg ha ⁻¹ + 33% FYM @ 4.125 ton ha ⁻¹ + 33% Jeevamrit @ 330 litre ha ⁻¹ at 15 D.I.	3237.66	1032.22	1600.57	462.51
S.Em±	33.82	23.32	26.33	12.82
CD (P=0.05)	102.59	70.76	79.87	38.89

Conclusion

Based on my research trail, the treatment combination 75% N:P₂O₅: K₂O @ 60:30:15kg ha⁻¹ + 25% FYM @ 3.125ton ha⁻¹ (T₄) was found to be more productive. Although the findings are based on one season further research is needed to confirm the findings and their recommendation.

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