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RESEARCH ARTICLE

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON LEAF YIELD OF SENNA(*CASSIA ANGUSTIFOLIA* VAHL.)

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ABSTRACT

A medicinal plant is any plant which contains substances that can be used for the therapeutic purposes and used as a precursor for the synthesis of useful drugs. India has been a big producer in medicinal and aromatic plants trade across the globe. India holds leading position in the production of senna crop and export of its produce to the world market, annuallyearning nearly 45 million. Almost all the senna leaves produced in India areexported and the major portion is transported to London market. Senna leaves are commonly used as a natural laxative both in modern and tradition system of medicine. Interagted Nutrient Management (INM) is considered as an integral part of any sustainable agricultural system. Thus an experiment was conducted on the "Effect of Integrated Nutrient Management on leaf yield of Senna (*Cassia angustifolia* Vahl.)" carried out at Paramathi Velur, Namakkal District, Tamil Nadu during the year 2019 - 2021. The field experimentwas consist of different combination of nutrients *viz*., recommended dose of fertilizers RDF, farmyard manure FYM, vermicompostVC and biofertilizers (Azospirillum AS and Phosphobacteria PB). Among the various treatments tried, plants supplied with T10 (75 % RDF + FYM @ 10 t ha^{-1} + Azospirillum @ 2.5 kg ha^{-1} + Phosphobacteria @ 2 kg ha^{-1}) recorded maximum leaf yield attributes such as fresh weight of leaves $plant^{-1}$, fresh weight ofshoots $plant^{-1}$, fresh leaf yield ha^{-1} and dry leaf yield ha^{-1}.

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INTRODUCTION

Senna (*Cassia angustifolia* Vahl.), commonly known as „sannai" in Tamil Nadu. It is a widely used medicinal herb in Ayurveda, unani, allopathic system of medicine and has been included in Indian, British and many other pharmacopoeias of the world. It is employedin various indigenous system of medicine against several diseases and almost every part of the plant has drives medicinal properties. Senna is an FDA (Food and Drug Administration) approved non-prescription laxative. Senna leaves are commonly used as a natural laxative both in modern and tradition system of medicine. It is mainly valued for its catharticproperties and is especially useful in habitual constipation. It helps to increase peristalsis movement which also causes reduction in water absorption and used in the treatment of haemorrhoids and weight loss (Mohammad Sadat, 2020). Leaves and pods of senna are the economic parts and are used as a medicine for treatment of abdominal disorders, jaundice, anaemia, bronchitis and splenomegaly. According to Ayurveda it has the property of reducing „Kapha" and „Vata". Senna belongs to the family Fabaceae and is one of the most significantmedicinal crops in India.

India has been a big producer in medicinal and aromatic plants trade across the globe. India is the second largest exporter of medicinal plants next to china. India holds leading position in the production of senna crop and export of its produce to the world market, annually earning nearly 45 million. Almost all the senna leaves produced in India areexported and the major portion is transported to London market. The crop is grown in about 10,000 ha, mainly in Southern districts of Tamil Nadu v*iz*., Tirunelveli, Ramanathapuram and Madurai (Kumar, 2018). The leaves and pods of senna contain sennosides which are having high medicinal properties (Randell *et al*., 2017). The long-term use of chemical fertilizers leadsto the deterioration of physical and chemical properties of soil. Continuous application of heavy doses of chemical fertilizers without using organic manures or bio fertilizers led to decline in soil microbial activities, ground water and environmental pollution. Organic manures and bio fertilizers improves the soil texture, allowing it to hold water longer, and increases the microbial activities in the soil. INM is considered as an integral part of any sustainable agricultural system. INM enhances the availability of applied as well as native soil nutrients and it synchronizes the nutrient demand (Mostafa, 2020).

MATERIALS AND METHODS

Experiment location and field preparation: The experiment was conducted at 11.112^0 North latitude, 78.0044^0 East longitude and at an altitude of 170 meters above the mean sea level in Tamil Nadu, India. The weather of theexperimental site is moderately warm with hot summer months. The field was ploughed well and brought to fine tilth. The soil type of the experimental field was sandy loam soil with pH - 7.45 and electrical conductivity of 0.40 dsm^{-1}. The field was levelled and divided into required number of plots. The plot size was 2.2 x 2.2 m^2 holding 35 senna plants. The soaked seeds are sown in line by hand dibbling with a spacing of 45 cm between rows and plant – plant spacing of 30 cm apart.

Source of inputs: Seeds of senna are collected from the wild types located at the foothills of Kollimalai. Organic inputs such as farmyard manure and vermicompost were collected from farmer‟s field in Olappalayam village. Inorganic fertilizers such as NPK (Urea, SSP, MOP) were procured from Velur Agri clinic located at Paramathi Velur. Bio fertilizers such as Azospirillum and phosphobacteria were collected from office of the Assistant Director of Agriculture located at Paramathi. The observations viz., fresh weight of leaves and shoots $plant^{-1}$ were recorded on 140 days after sowing from the randomly tagged 5 existing plants whereas fresh and dry yield of leaves obtained from the net plots were weighed and the weightwas worked out at ha^{-1} basis and expressed as q ha^{-1}.

Treatment details: The experiment was laid out in Randomized Block Design with twelve treatments and three replications. The twelve treatments *viz*., T1 - 100 % RDF (80:40:20 kg NPK ha^{-1}), T2 - FYM @ 10 t ha^{-1}, T3 - VC @ 4 t ha^{-1}, T4 - 75 % RDF + FYM @ 10 t ha^{-1}, T5 - 50 % RDF + FYM @ 10 t ha^{-1}, T6 - 75 % RDF + VC @ 4 t ha^{-1}, T7 - 50 % RDF + VC @ 4 t ha^{-1}, T8 – 75 % RDF + VC @ 4 t ha^{-1} + VC @ 2.5 kg ha^{-1}+ PB @ 2 kg ha^{-1}, T9 - 50 % RDF + VC @ 4 t ha^{-1} + VC @ 2.5 kg ha^{-1} + PB @ 2 kg ha^{-1}, T10 - 75 % RDF + FYM @ 10 t ha^{-1} + VC @ 2.5 kg ha^{-1} + PB @ 2 kg ha^{-1}, T11 - 50 % RDF + FYM @ 10 t ha^{-1} + VC @ 2.5 kg ha^{-1} + PB @ 2 kgha^{-1} and T12 - Control. The observations were recorded on 140 days after sowing fromthe randomly tagged 5 existing plants. The observed data was analysed by using statistical method of Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

From the various treatments implemented to the plants treatment T10 was observed torecord the highest fresh weight of leaves and shoots $plant^{-1}$ (36.52 g) and (38.61 g) respectively due to the influence of nitrogen, which is essential for the formation of protoplasm, that leads to cell division and cell enlargement. In addition to this, biofertilizers in combination with inorganic and organic manures enhanced the available nitrogen and assisted the host plant to promote fresh weight of leaves and shoots. These were achieved in the integrated treatments which could be attributed to higher microbial population and dehydrogenase activity, which may have greater influence on nutrient uptake, chlorophyll synthesis and plant growth. Such positive responses of integrated nutrient treatments in sennawere also reported by , Divya *et al*. (2017) in kalmegh, Sonali *et al*. (2018) in foxglove and Abeer *et al*. (2019) in rosemary.

Table 1. Influence of integrated nutrient management on leaf yield characters ofsenna (*Cassia angustifolia* Vahl)

Treatment	Fresh leaf weight (g $plant^{-1}$)	Fresh shoot weight (g $plant^{-1}$)	Fresh leaf yield (q ha^{-1})	Dry leaf yield (q ha^{-1})
T1	25.04	25.87	13.97	3.88
T2	21.88	22.45	11.82	2.96
T3	23.48	24.14	12.91	3.42
T4	29.71	31.01	17.14	5.14
T5	26.57	27.62	15.05	4.25
T6	31.22	32.65	18.17	5.54
T7	28.15	29.34	16.06	4.73
T8	35.09	36.98	20.80	6.44
T9	32.80	34.33	19.17	5.88
T10	36.52	38.61	21.79	6.78
T11	34.32	35.98	20.47	6.26
T12	20.27	20.72	10.71	2.49
S.Ed	0.389	0.524	0.298	0.89
CD (p=0.05)	1.045	1.091	0.627	0.184

The results of this study revealed that the fresh and dry leaf yield were significantly influenced by the integrated use of inorganic fertilizers, organic manures and biofertilizers. The fresh and dry leaf yield was influenced by leaf and shoot weight $plant^{-1}$. The highest fresh and dry leaf yield were recorded with the plants treated with T10 (21.79 q ha^{-1})(6.78 q ha^{-1}).It may be due to the increased availability of nutrients and other growth promoting substances supplied by the synthetic fertilizers and biofertilizers. Nitrogen is essential for the formation of protoplasm which leads to cell division and cell enlargement. Thereby nitrogen is an important nutrient for higher yield of leaves in senna (Ilangovan *et al*., 1990). Such positive responses of integrated nutrient treatments in increased leaf yield of senna was also reported by Singaravel *et al*. (2016), Shaza Bakri (2017) and Dhoti *et al*. (2020).

CONCLUSION

Based on the observation recorded, it could be concluded that among the various treatments of Integrated nutrient management on senna (*Cassia angustifolia* Vahl.), the maximum leaf yield was observed on the plants treated with T10. The combined use of organic fertilizers, and bio-fertilizers along with inorganic fertilizers, recorded significantly maximum growth attributes in senna plant due to increased soil fertility through proper integrated nutrientmanagement.

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