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Effect of Bio Stimulants on Growth and Yield of Senna (*Cassia angustifolia* var. KKM.1)

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Abstract: Senna (*Cassia angustifolia*), a traditional medicinal crop in Tamil Nadu warrants the modern quality guidelines *viz*. Good Agricultural Practices (GAP) for marketing overseas. Buyers of developed countries insist on GAP and organic certification for medicinal plants. With this in view, an experiment was conducted at Medicinal Plants Unit, Botanic Garden, Tamil Nadu Agricultural University, Coimbatore to study the effect of various biostimulants on yield and yield attributing characters to standardize the biostimulant(s) for higher yield. The treatments included different concentrations of panchakavya (2% and 4%), moringa leaf extract (2 and 4%) and humic acid (0.2 and 0.4%). The field was laid out in randomized block design. Vermicompost at 4 t ha^{-1} was applied commonly to all the plots. Spraying with the above said chemicals was done at 15 days interval from 30 days after transplanting for four times. The observations were recorded for growth a yield characters and were statistically analyzed. The treatment 2% panchakavya + 2% moringa leaf extract + 0.2% humic acid recorded the highest value of growth and yield characters like plant height (44.58 cm), number of branches (6.1), number of pods (53.0), dry leaf yield (560.8 kg / acre) and dry pod yield (6. 72 g / plant).

Key words: Senna · Bio stimulants · Panchakavya · Humic acid · Moringa Leaf Extract

INTRODUCTION

The global market of medicinal plants is over 60 billion US $ per year, which is growing at the rate of seven percent. India, at present, exports herbal materials and medicines to the tune of Rs. 446.3 crores, as against Rs. 20,000 crores from China. The export potential of the country can be raised to about Rs.3000 crores by the end of the year 2005. An estimated survey indicated that the use of herbal medicine will reach to the tune of three trillion US $ during 2050, (http://www.kurzweilai.net). Currently, WHO encourages, recommends and promotes the inclusion of herbal drugs in national health care programmes, because such drugs are easily available at a reasonable price within the reach of common man and as such are time tested and thus considered to be much safer than the modern synthetic drugs. Senna (*Cassia angustifolia* vahl) belongs to Caesalpinaceae family is a small perennial shrub of less than a meter in height ascending branches. *Cassia angustifolia* is native to India and is cultivated mainly in India. The parts of this plant used medicinally are the leaves and the pods. Both the leaves and pods are used in many over-the-counter pharmaceutical preparations. It is recognized by British and US pharmacopoeias. The leaves are useful in habitual costiveness. It lowers bowels, increases peristaltic movements of the colon by its local action upon the intestinal wall. It is used as expectorant, wound dresser, antidysentric, carminative and laxative. Use of organic manures to meet the nutrient requirement of crop would be an inevitable practice in years to come for sustainable agriculture. Foliar application of growth stimulants resulted better yield in many crops. With this view a research had been conducted to study the effect of bio stimulants for better growth and yield of *Cassia angustifolia*.

MATERIALS AND METHODS

The experiment was conducted at Medicinal Plants Unit, Botanic Garden, Tamil Nadu Agricultural University, Coimbatore to study the effect of various biostimulants on yield and yield attributing characters to standardize the biostimulant(s) for higher yield. Seed material of KKM -1 senna was collected from a reputed farmer at Virudhunagar and the seeds were directly sown on the field with a spacing of 30 cm x 30 cm. The field was regularly irrigated once in a week and cleanly maintained by proper weeding. The field was laid out in randomized block design. The treatments included

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different concentrations of panchakavya (2% and 4%), moringa leaf extract (2 and 4%) and humic acid (0.2 and 0.4%) as foliar spray at 15 days interval from 30 days after planting up to 90 days after planting. The treatment details are as follows.

Treatment Number	Treatment Details
T_1	Panchakavya (PK) 2%
T_2	Humic acid (HA) 0.2%
T_3	Moringa Leaf Extract (MLE) 2%
T_4	Panchakavya (PK) 4%
T_5	Humic acid (HA) 0.4 %
T_6	Moringa Leaf Extract (MLE) 4 %
T_7	Panchakavy 2% + humic acid 0.2%+ Moringa Leaf Extract 2%
T_8	Panchakavy 4% + humic acid 0.4%+ Moringa Leaf Extract 4%
T_9	Control

Vermicompost at 4 t ha^{-1} was applied commonly to all the plots. Growth and yield related attributes like plant height, number of branches, days taken for flowering, number of pods, foliage yield were observed at different stages of plant growth and the data were statistically analyzed [1].

RESULTS

The influence of biostimulants application on *Cassia angustifolia* for growth and yield attributes were significantly differed between the treatments. Invariably all the parameters were responded well for the treatment combination of Panchkavya 2% + humic acid 0.2%+ Moringa Leaf Extract 2%. The highest plant height of 9.70, 27.24 and 44.58 cm at vegetative, flowering and harvesting stage of plant growth was observed in the above said treatment combination of Panchkavya 2% + humic acid 0.2%+ Moringa Leaf Extract 2% followed by that recorded with humic acid at 0.2% spraying.. This finding was coincide with the findings of Thamaraiselvi [2] on *Rosa centifolia*. The lowest plant height was observed in the control treatment (without any spraying).

The result for number of braches was nonsignificant among the treatments. even though the plots sprayed with Panchkavya 2% + humic acid 0.2%+ Moringa Leaf Extract 2% recorded the highest number of branches (6.1), this was on par with other treatments.

Number of pods per plant was significantly differed among the treatments. The highest number of pods per plant (53.0) was observed in the treatment Panchkavya 2% + humic acid 0.2%+ Moringa Leaf Extract 2%. Dry pod yield per plant also higher (6.72) in the same treatment followed by Panchakavy 4% + humic acid 0.4%+ Moringa Leaf Extract 4% which recorded 5.52 g of dry pod per plant and the control treatment recorded the lowest dry pod yield (4.11 g). This was in line with the findings of Beaulah [3] in moringa.

Table 1: Effect of Bio Stimulants on plant growth attributes of Senna (*Cassia angustifolia* var.Kkm.1)

Treatments	Plant height at vegetative stage (cm)	Plant height at flowering stage (cm)	Plant height at harvesting stage (cm)
T1	9.08	25.48	38.61
T2	9.50	26.01	40.17
T3	8.30	25.66	37.12
T4	9.80	25.60	42.06
T5	9.40	25.97	37.27
T6	8.70	26.36	37.15
T7	9.70	27.24	44.58
T8	8.70	25.84	37.05
T9	8.30	23.40	35.25
SE(d)	0.680	0.715	1.180
CD(P=0.05)	NS	1.515	2.501

Table 2: Effect of Bio Stimulants on yield attributes of Senna (*Cassia angustifolia* var.Kkm.1)

Treatments	No of branches	No of pods/plant	Dry pod yield g/plant	Dry leaf yield Kg/acre
T1	4.2	46.2	4.81	520.4
T2	4.2	48.3	4.70	519.8
T3	4.4	43.9	4.92	522.3
T4	4.3	49.3	5.10	528.8
T5	5.0	44.7	5.31	529.2
T6	5.2	45.2	5.41	530.5
T7	6.1	53.0	6.72	560.8
T8	5.2	45.3	5.52	538.6
T9	3.5	43.5	4.11	435.4
SE(d)	0.365	1.534	0.342	1.176
CD(P=0.05)	NS	3.251	0.725	2.492

The dry leaf yield also significantly differed among the treatments and the highest dry leaf yield (560.8 kg/ acre) was recorded in the treatment Panchkavya 2% + humic acid 0.2%+ Moringa Leaf Extract 2% followed by the application of Panchakavy 4% + humic acid 0.4%+ Moringa Leaf Extract 4% with the yield of 538.6 kg /acre. The lowest dry leaf yield (434.4 kg/ acre) was seen in the plot without any spray. Such results were recorded on baccopa.[4] and *Solanum nigrum* [5].

DISCUSSION

The present study has created an interesting data with respect to plant growth and yield characters. This may be due to Effective Micro Organisms (EMO) and Methylotrophs Profile Bacteria in panchagavya would have enhanced the production of phytohormones like auxins and gibberellins that might have stimulated the growth by increasing the plant height, number of branches as evidenced from the work of Xu *et al.* [5] and Hartwigson and Evans [6]. Humic acid influences plant growth through modifying the physiology of plants and by improving the physical, chemical and biological properties of soil [7, 10]. Humic acid provides carbon as an energy source to nitrogen fixing bacteria and thus proves its biological function [8]. The natural bio-regulators in moringa leaf extract also increased the dry matter production registered increased yield compared to control. Moringa leaf extract spray increased the yield in crops like peanut (5319 kg per hectare), onion (4194 kg per hectare) and blackbean (1194 kg per hectare) compared to their respective control [9]. The gibberellins like activity of humic acid as reported by Vaughan [8] may lead to broader and elongated leaves which in turn increase the photosynthetic efficiency of the crop lead to more biomass accumulation over the control. Thus all the positive effects of the biostimulants viz., Panchakavya, humic acid and Moringa Leaf Extract had combined synergistic influence on better growth and yield of *Cassia angustifolia* this was supported with the findings of Jayashanker *et al.* [10] and Rajamani *et al.* [11].

CONCLUSION

The treatment combination of Panchkavya 2% + humic acid 0.2%+ Moringa Leaf Extract 2% resulted highest growth and yield values of senna (*Cassia angustifolia*).

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