



**ORIGINAL RESEARCH PAPER**

**Agronomy**

**INFLUENCE OF INM ON PHYSIOLOGICAL AND YIELD TRAITS OF COTTON (*Gossypium hirsutum* L.) INFLUENCED BY ORGANIC MANURE AND FOLIAR SPRAY**

**KEY WORDS:** INM, FYM, VC, Bio-fertilizer, Foliar spray

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**ABSTRACT**

Use of organic manures in agriculture is considered as environmental friendly and an economical approach to get maximum output in existing agricultural production system. Unselective use of organic manures is often used in the agriculture to improve soil health but it cannot significantly increase the yield. Application of organic and inorganic source of nutrients can uplift the economics of existing cotton based production systems by improving soil health and reducing the cost of inorganic nutrients per unit area. This study was executed to quantify the best possible combination of integrated nutrients for cotton crop. The present study pertains to the effect of Integrated Nutrient Management (INM) on growth and yield of cotton under irrigated condition. The nine treatment combinations comprising of organic manures (FYM, vermicompost), foliar spray (Panchagavya and Dasagavya), inorganic fertilizers (NPK) and bio-fertilizers. T<sub>1</sub>- Control, T<sub>2</sub>- FYM @ 10 t ha<sup>-1</sup>+Bio fertilizer (soil application) +50 % RDF, T<sub>3</sub>- Vermicompost @ 2.5 t ha<sup>-1</sup>+ Bio fertilizer + 50% RDF, T<sub>4</sub>- T<sub>2</sub>+ Panchagavya @ 3% (2 sprayings), T<sub>5</sub>- T<sub>2</sub>+Dasagavya @ 3% (2 sprayings), T<sub>6</sub>- T<sub>3</sub>+ Panchagavya @ 3% (2 sprayings), T<sub>7</sub>- T<sub>3</sub>+ Panchagavya @ 3% (2 sprayings), T<sub>8</sub>- Panchagavya @ 3% (2 sprayings), T<sub>9</sub>- Dasagavya @ 3% (2 sprayings). The experimental result showed that the significantly highest growth and yield were recorded under T<sub>6</sub>- Vermicompost @ 2.5 t ha<sup>-1</sup>+ BF+50% RDF+ Panchagavya spray @ 3% (2 sprayings). In conclusion, combined application of Vermicompost @ 2.5 t ha<sup>-1</sup>+Bio fertilizer+50% RDF+ Panchagavya spray @ 3% foliar spray could be the economical approach to attain the higher seed cotton yield.

**INTRODUCTION**

Cotton is one of the most important fiber and a cash crop of India and plays a dominant role in the industrial and agricultural economy of the country. Worldwide area under cotton for the year 2020-21 was 31.66 million hectares and production and productivity accounted for 113.11 million bales and 778 kg ha<sup>-1</sup> respectively. India has emerged as the larger producer of cotton in the World and occupies the first position in terms of total area and production. Among the major cotton exporting countries in the World, India occupies first position in terms of total area and production. Among the major Cotton exporting countries in the World, India occupies third position with 5.5 million bales (USA-16.5 million bales and Brazil -10.70 million bales). (USDA, 2020-21)

Integrated nutrient management is also described as the technique of using minimum effective dose of sufficient and balanced quantities of organic and inorganic fertilizers in combination with specific microorganisms to make nutrients more available and most effective for maintaining high yields without exposing soil native nutrients and polluting the environment. Furthermore, many benefits can also be gained from using integrated nutrient management. INM can act as the driving forces, able to support the plans of converting marginal lands into productive ones, therefore fulfilling the strategy agendas of increasing cultivated land. (Selim 2020)

FYM is a mixture of cattle dung, urine, litter or bedding material, portion of fodder not consumed by cattle and domestic wastes are collected and dumped into a pit or heaped in the corner of the backyard. It is allowed to remain there and rot until it is taken out and applied to the fields (Rex Immanuel *et al.*, 2019)

Farm yard manure (FYM) application had positive effect on

plant height and seed yield of cotton due to enhanced carbon sequestration in soil and other improved soil properties. (Muhammad Jan *et al.*, 2021). FYM must be treated appropriately and recycled by land application to meet all the nutrient demands of crops and to reduce mineral fertilizer use (Mori *et al.*, 2020).

Vermicompost is a nutrient - rich, stabilizing micro biologically-active organic amendment that results from the interactions between earthworms and microorganisms (Mawiyah Mahmud *et al.*, 2019) during the breakdown of organic matter. It helps to improve crop health, soil structure soil quality and acts preventively against fungal diseases, suppresses their occurrence, increases water holding capacity, yield and improves food quality (Kaluram Khede *et al.*, 2019).

The term bio-fertilizer can be defined as formulations comprised of living microbial cells, either a single strain or multiple strain that promote plant growth by increasing nutrient availability and acquisition (Riaz *et al.*, 2020). Bio-fertilizers can also provide other direct and indirect benefits for plant growth, such as phyto-stimulation, abiotic stress tolerance and bio-control (Shirmohammadi *et al.*, 2020)

Foliar fertilization is gaining more importance in recent years, the use of fermented cow dung, cow urine, cow ghee, cow curd and milk with the name of *panchagavya* is getting adaptive popularity in Indian agriculture largely through the efforts of small groups of farmers and is of great significance in the present scenario nutrients scheduling. *Panchagavya*, an organic product has the potential to play the role in promoting growth and providing immunity in plant system (Choudhary *et al.*, 2018). The use of liquid organic manures like *panchagavya* results in higher soil organic carbon, growth, yield, and quality of crops (Perminder Singh Bhar *et al.*, 2019).

Dasakavya are the effective organic spray which are used as a growth stimulator, growth promoter and immunity booster. Beneficial microorganisms could have stimuli in plant growth and increased the production of growth regulators in plant system, it enhances the spatial distribution of soil microbial diversity (Solanki *et al.*, 2015).

Keeping all the views in mind an experiment was planned to find out the influence of INM on physiological and yield traits of cotton influenced by organic manures and foliar spray.

**MATERIALS AND METHODS**

The field experiments were conducted at farmer's field, Bommanaickenpalayam village, Gobichettipalayam Taluk, Erode District during (Feb 2019- Aug 2019). The variety Surabhi was chosen for this study. The experimental site is geographically situated at 10°74' N latitude and 77° 15' E longitude with an altitude of about + 213 m above mean sea level (MSL). The mean maximum and minimum temperature are 36° and 27°C respectively. The relative humidity range from 5 to 63 per cent. The experimental plots had assured irrigation facility coupled with uniform topography, good drainage and soil suitable for cotton cultivation. The soil of the experimental farm is classified as udic chrom (clay) according to FAO/UNESCO (1974). The soil is low in available Nitrogen, medium in available Phosphorous and high in available Potassium. The experiment was laid out in randomized block design with three replications. The treatment comprised of nine treatments viz., T<sub>1</sub>- Control , T<sub>2</sub>- FYM @ 10 t ha<sup>-1</sup>+Bio fertilizer (soil application) +50% RDF, T<sub>3</sub>- Vermicompost @ 2.5 t ha<sup>-1</sup>+Bio fertilizer+50% RDF , T<sub>4</sub> - T<sub>3</sub>+ Panchagavya @ 3% (2 sprayings), T<sub>5</sub>- T<sub>2</sub>+Dasagavya @ 3% (2 sprayings), T<sub>6</sub> - T<sub>3</sub>+ Panchagavya @ 3% (2 sprayings), T<sub>7</sub>- T<sub>3</sub>+ Panchagavya @ 3% (2 sprayings), T<sub>8</sub>- Panchagavya @ 3% (2 sprayings), T<sub>9</sub> - Dasagavya @ 3% (2 sprayings). to study the cumulative effect of INM involving use of organic manures (FYM and vermicompost) and organic sprays (Panchagavya and Dasagavya) on growth and yield of cotton. FYM @ 10 t ha<sup>-1</sup> and vermicompost @ 2.5 t/ha were incorporated uniformly at the time of last ploughing. Fertilizer was applied according to treatment schedule for cotton. For cotton, recommended dose of 80:40:40 kg ha<sup>-1</sup> of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was applied. Nitrogen was applied in two equal splits viz., half the dose of N and full dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied at 20 DAS and remaining half dose N was applied at 40 DAS. The *Azotobacter* and *Phosphobacteria* were applied in soil @ 2 kg ha<sup>-1</sup>. The required quantity of each of the bacterial culture was mixed with 25 kg of sand and applied 3 days before sowing evenly over the respective plots as per the treatment schedule. The foliar spraying of Panchagavya, Dasagavya @ 3 per cent foliar spray was done as per treatment schedule at 45 and 75 DAS using hand operated knapsack sprayer. While taking observations, five plants from sampling rows were pulled off in each treatment plot for recording dry matter production. The statistical analysis was done as per procedure suggested by Gomez and Gomez (1984).

**RESULTS AND DISCUSSION**

**Growth attributes**

The study revealed that the highest growth attributes plant height (175.65cm), DMP (7775.46 kg ha<sup>-1</sup>), LAI (6.65) of cotton were influenced significantly by the combination of organic manures and foliar spray viz., VC @ 2.5 t ha<sup>-1</sup> +BF+RDF +Panchagavya @ 3% (2 sprayings) (T<sub>6</sub>). This might be due to application of vermicompost which enhances nutrient mobility; thus, plant uptakes more nutrient, which improves growth and yield attributes. Results of this study are in line with several earlier work of (Kannan *et al.*, 2013 and Younas *et al.*, 2021). In panchagavya spray, the easy transfer of nutrients to plant through foliar spray and the quantities of IAA and GA present in panchagavya, could have created the stimuli in the plant system and which in turn increased the production of growth regulators, in cell system and it enhances the biological efficiency of crop plants (Gunasekhar *et al.*, 2018). Higher growth is further due to balanced supply of all important nutrients to the plants by RDF. (Yousaf *et al.*, 2017). In addition to this *Azotobacter* has ability to synthesize auxins, vitamins, growth substances and antifungal antibiotics conferred it with supplementary advantage. The nitrogen which is being fixed by *Azotobacter* in soil near root zone was absorbed by the roots that might have improved the growth parameters of crop. (Togas *et al.*, 2017).

**Yield attributes**

The result also exhibited that the highest yield components of cotton like number of monopodial branches plant<sup>-1</sup> (3.72), number of sympodial branches plant<sup>-1</sup> (31.88), number of squares plant<sup>-1</sup> (55.12), number of bolls plant<sup>-1</sup> (36.35), boll weight (4.32 g) and seed cotton yield (2688.12 t ha<sup>-1</sup>) were increased under VC @ 2.5 t ha<sup>-1</sup> +BF+RDF +Panchagavya @ 3% (2 sprayings) (T<sub>6</sub>). All the growth attributes specially LAI help in plant photosynthesis, which ultimately help in yield attributes. The high yield is thus due to the availability of more nutrients i.e. the results in nutrient application was better due to additional supply of nutrients through vermicompost which might have increased nutrient uptake and better translocation of nutrients. The results collaborates with the findings of Vala *et al.*, (2018); Kumar *et al.*, (2012). Inoculation of symbiotic nitrogen fixers like *Azotobacter* improve plant growth and yield due to supplementing the growing plants with fixed nitrogen and growth promoting substances. (Singh *et al.*, 2015). Further smaller quantities of IAA and GA present in panchagavya when foliar sprayed could have created stimuli in the plant system which in turn increased the production of growth regulator in cell system and the action of growth regulators in plant system stimulated the necessary growth and development, leading to better yield (Gopal Lal Choudhary *et al.*, 2017). In addition to this higher yield attributes might be due to the immediate release and availability of nutrients by inorganic sources of nutrients compared with organic manures or even the combined use of inorganic and organic manures and it may stimulate the activities of microorganisms that made the plant nutrients readily available to the crops. (Kulkarni *et al.*, 2018).

Treatments	Growth attributes			Yield attributes					Yield
	Plant height at harvest (cm)	DMP at harvest (kg ha <sup>-1</sup> )	LAI at 70 DAS	Monopodia l branches per plant	Sympodial branches per plant	No. of squares per plant	No. of bolls per plant	Boll weight (g)	Seed cotton yield (q ha <sup>-1</sup> )
T <sub>1</sub>	129.53	6573.16	5.49	2.37	16.77	43.57	30.04	3.20	2319.78
T <sub>2</sub>	152.11	7226.34	6.21	3.33	24.73	50.97	33.88	3.79	2562.98
T <sub>3</sub>	154.22	7227.13	6.23	3.35	26.20	50.98	33.97	3.99	2563.67
T <sub>4</sub>	156.98	7229.01	6.28	3.39	29.09	51.42	36.42	4.04	2566.10
T <sub>5</sub>	155.23	7228.12	6.25	3.37	27.68	51.40	36.40	4.01	2565.15
T <sub>6</sub>	<b>175.65</b>	<b>7555.46</b>	<b>6.65</b>	<b>3.72</b>	<b>31.88</b>	<b>55.12</b>	<b>36.35</b>	<b>4.32</b>	<b>2688.12</b>
T <sub>7</sub>	175.63	7554.11	6.62	3.62	31.78	55.10	36.32	4.29	2686.12
T <sub>8</sub>	141.41	6900.34	5.86	3.08	20.86	47.28	31.97	3.50	2442.62
T <sub>9</sub>	140.21	6899.16	5.49	3.02	19.42	47.25	31.95	3.46	2440.25
S.Ed	3.63	111.25	0.11	0.07	0.51	1.25	0.64	0.08	41.08
CD (p=0.05)	10.60	324.87	0.33	0.21	1.51	3.66	1.88	0.24	119.96

## CONCLUSION

The results and discussion of the above study concluded that application of VC @ 2.5 t ha<sup>-1</sup> +BF+RDF +Panchagavya @ 3% (2 sprayings) resulted in higher growth and yield attributes of cotton. As it holds a promise as an combination for improved crop production and also for maintenance of soil fertility and highly favourably increased growth and yield of cotton. Besides it offers a great scope in effective utilization of organic sources in Agriculture.

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