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# IMPACT OF FOLIAR APPLICATION AND SOIL DRENCHING ON COTTON (*Gossypium hirsutum* L.) IN VERTISOLS

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## ABSTRACT

**An experiment was conducted to study the effect of compost tea as a foliar application and soil drenching on biochemical parameter growth, yield and yield attributes of cotton grown in Vertsols. The present study was conducted at Research Farm of Department of Soil Science and Agricultural Chemistry, VNMKV, Parbhani during *kharif* 2022-23. The experiment was laid out in RBD with seven treatments and three replications. The experimental statistics indicated that plant height, leaf area, chlorophyll, number of bolls plant$^{-1}$, boll weight (g boll$^{-1}$), dry matter (kg$^{-1}$), cotton yield (q ha$^{-1}$) was significantly influenced by the application of compost tea. Significantly maximum results for all parameters were obtained by the application of 100% RDF (B:C ratio 1.71) which was statistically at par with 75% RDF+ 75% compost tea foliar spray (B:C ratio 1.60). The data unambiguously showed that the foliar application of compost tea decreased the 25% RDF with an acceptance reduction of 5% yield and 0.1% B:C ratio in comparison to 100% RDF.**

**(Key words: Compost tea, quality, cotton, yield, ecological sustainability, Vertisols)**

## INTRODUCTION

Inorganic fertilizers have significant effect on world crop production and become essential component of today's agriculture. Of the total applied N, less than 50% is recovered in the soil plant system, while the remaining is lost to the environment. The negative impact of inorganic fertilizer on the environment and their future cost made it expedient to integrate use of organic materials in cultivation practices to enhance crop yields. The conjunctive use of organic nutrient sources with inorganic fertilisers was shown to increase the potential of organic fertiliser and to improve the efficiency of inorganic fertiliser so that the use of these fertilisers could be reduced up to certain levels. The use of microbe-enriched compost tea for nutrient mobilisation is becoming popular, and new systems are being developed to meet the requirements of different crops and cropping systems.

Several studies have reported benefits from the use of compost and compost tea as organic substrate additives in plant cultivation and in the suppression of soil-borne diseases. Cotton is commonly known as "White Gold" in farming community. It is a multipurpose crop that supplies 5 basic products *viz;* lint, oil, seed meal, hulls and linters.

Due to its multipurpose nature and use, it has huge demand from industry side, which makes this crop popular among the farming community. In cotton production, Maharashtra is foremost state in India. It covers around 36 per cent cotton area of the country and contributes around 22 per cent of its production. Hence, performance of cotton was analysed on important parameters at state level. The use of organic manures to reduce the chemical fertilizer consumption is important. The organic inputs directly or indirectly affect the microorganisms in soil. Microorganisms in the rhizosphere significantly contribute to plant growth and micro-ecological maintenance. Rhizosphere microorganisms produce various plant growth-promoting hormones and biological control agents to enhance nutrient mineralization and availability. The literature on compost tea as a nutrient source speculates that compost tea improves nutrient use efficiency. Temiz *et al.* (2009) studied the importance of using humic substances in cotton is to balance vegetative and reproductive growth as well as to improve lint yield and fibre quality. However, studies focusing on the relationship between CT and soil properties/ nutrient use efficiency have been few. The main objective of the current study was to understand the influence of application of compost tea on crop growth, productivity of cotton crop and reduction of use of chemical fertiliser in production of cotton crop.

## MATERIALS AND METHODS

This investigation was conducted at Research Farm of Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* 2022-23. The soils of the present experiment were classified as Vertisol soil order belonging to Parbhani soil series which comprise of fine Montmorillonite isohyperthermic family of Typic Haplusterts. The required

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quantity of compost tea was prepared and its characterization *viz*., pH, electrical conductivity by pH meter and electrical conductivity by electrical conductivity meter, total N P K and DTPA extractable micronutrients (Fe, Mn, Zn, Cu) were estimated as per method suggested by Piper (1966). The experimental plot was laid out in a randomized block design (RBD). Plot size was 7.2 x 5.4 $m^2$ and row to row distance was 90 cm and plant to plant distance was 60 cm. The Rasi (RCH 386 BG II) variety was tested in the present study with three replications and seven treatments *viz*., $T_1$ - Absolute control, T2 - RDF (150:75:75 NPK kg $ha^{-1}$ + S @25 kg $ha^{-1}$), T3 - 75 % RDF + 50 % CTF, T4 - 75 % RDF + 75 % CTF, T5 - 75 % RDF + 25 % CTS, T6 - 50 % RDF + 50 % CTS and T7 - 25 % RDF + 75 % CTS. The abbreviations CTF means compost tea foliar spray at 30, 75 and 120 DAS and CTS means compost tea soil drenching at 30 and 45 DAS. The fertilisers urea, SSP and MOP were applied for N, P, K and S respectively. The data on plant height and leaf area were recorded at 30,90 and 120 DAS, chlorophyll pigment was estimated by using the DMSO method (Swain and Hillis, 1959) at flowering and boll formation stage, number of bolls $plant^{-1}$ at flowering, boll formation and at harvest. Observation on mean boll weight, dry matter and yield of cotton were also recorded. Nutrients use efficiency and B:C ratio were also calculated.

**Chemical composition of compost tea**

The chemical characteristics of prepared compost tea indicated that the compost tea was alkaline in pH (7.6) and electrical conductivity was 3.5 $dSm^{-1}$. The total N, P and K content in compost tea was 0.83 per cent, 0.42 per cent and 0.59 per cent respectively. The micronutrients content in compost tea were Cu 0.63 mg $l^{-1}$, Fe 15.14 mg $l^{-1}$, Mn 3.08 mg $l^{-1}$ and Zn 2.41 mg $l^{-1}$ respectively. Similar findings also quoted by (Naidu *et al*., 2013). Compost tea is gaining importance as an alternative to chemical fertilizers and pesticides. The microbial population in the compost tea contributes toward its effectiveness.

# RESULTS AND DISCUSSION

**Effect of compost tea on the growth of cotton**

**Plant height (cm)**

The data regarding the plant height were recorded at 30, 90,120 DAS are presented in Table 1. From the result, it is clear that application of compost tea at various stages of the crop had a substantial impact on plant height, which increased with advanced stage. The treatment $T_2$ – 100% RDF recorded significantly higher plant height at 30 DAS (21.53 cm), 90 DAS (89.78 cm) and 120 DAS (133.80 cm) over rest of the treatments and control. Whereas, the minimum height of plant was observed with treatment $T_1$ – control at 30 DAS (15.72 cm), 90 DAS (57.63 cm) and 120 DAS (94.40 cm) of cotton. Some other treatments were also significantly superior over control i.e $T_4$ – (75 % RDF + @ 75 % CTF at 30, 75 and 120 DAS), $T_3$ – (75 % RDF + @ 50 % CTF at 30, 75 and 120 DAS) and $T_5$ – (75 % RDF + @ 25 % CTS at 30 and 45 DAS) at 30, 90 and 120 DAS in a descending manner. Fertilizers typically provide a balanced mix of essential nutrients like nitrogen, phosphorus, and potassium, tailored to the specific needs of the crop. This balanced nutrient supply supports various growth processes. The increase in plant height in compost tea treated plots might be due to increased availability of nutrients at the initial stage through organic manures in addition to nutritional and other benefits from compost tea. Similar results were also reported by Padghan *et al.* (2018), who reported that foliar application of humic acid and NAA may have contributed to an increase in morphophysiological parameters *viz*., plant height, number of branches, leaf area, and total dry matter by accelerating several plant metabolic processes that resulted in increased apical development.

**Mean leaf area $plant^{-1}$ ($cm^2$)**

Results pertaining to the mean leaf area $plant^{-1}$ measured at 30, 90, and 120 DAS are presented in Table 1. It is clear from the results that the mean leaf area $plant^{-1}$ was affected by the application of compost tea. The maximum leaf area $plant^{-1}$ was noticed with the treatment $T_2$ – 100% RDF that recorded significantly higher leaf area at 30 DAS (102.79 $cm^2$), 90 DAS (147.91$cm^2$) and 120 DAS (96.67 $cm^2$) over rest of the treatments. But it is non-significant at 30 DAS and 120 DAS. Whereas the minimum leaf area $plant^{-1}$ was observed with treatment $T_1$ – control at 30 DAS (69.15 $cm^2$), 90 DAS (118.86 $cm^2$) and 120 DAS (73.93 $cm^2$) of cotton and all other treatments were significantly superior to it. However, the resultant treatment $T_2$ (RDF (150:75:75 NPK kg $ha^{-1}$ + S @25 kg $ha^{-1}$) showed statistically at par with the treatment $T_4$ (75 % RDF + @ 75 % CTF at 30, 75 and 120 DAS) (146.61 $cm^2$), $T_3$ – (75 % RDF + @ 50 % CTF at 30, 75 and 120 DAS) (142.97 $cm^2$) and $T_5$ – (75 % RDF + @ 25 % CTS at 30 and 45 DAS) (139.23 $cm^2$) at 90 DAS. Adequate fertilization enhances the photosynthetic capacity of cotton plants, leading to an increase in the production of carbohydrates and energy, which fuels plant growth and development. The increase in leaf area of compost tea applied plots might be due to the presence of essential components i.e. macro and microelements, vitamins, and phytohormones required for cell division and elongation in compost tea. The above results are in line with Ghuddhe *et al.* (2019), who stated that an increase in several leaves and its expansion might be due to the availability of nutrients through foliar application of humic acid and NAA which increased the number of leaves $plant^{-1}$.

**Chlorophyll content**

The data regarding chlorophyll content of cotton crop affected by application of compost tea are presented in Table 1. The chlorophyll content ranged from 1.60 to 2.11 mg $g^{-1}$ and 2.19 to 2.72 mg $g^{-1}$ during flowering and boll formation stages respectively The maximum chlorophyll content was observed in treatment $T_2$ – 100 % RDF (2.11 and 2.72 mg $g^{-1}$) at flowering and boll formation stages respectively which was statistically on par with treatment $T_4$ – 75 % RDF + @ 75 % CTF (2.00 and 2.57 mg $g^{-1}$), $T_3$ – 75

% RDF + @ 50 % CTF (1.99 and 2.52 mg $g^{-1}$) and $T_5$ – 75 % RDF + @ 25 % CTS (1.99 and 2.47 mg $g^{-1}$) at both flowering and boll formation stages. The remaining all treatments ($T_6$ - 50 % RDF + 50 % CTS and $T_7$ - 25 % RDF + 75 % CTS) resulted in significantly higher chlorophyll content over absolute control (1.60 and 2.19 mg $g^{-1}$) which noticed with minimum chlorophyll content at flowering and boll formation stages. The recommended dose of fertilizer is designed to provide crops with the optimal amount of essential nutrients they need for growth. This might be due to enhancement of metabolic activity via exploiting compost tea with their high nutritional value.

**Effect of compost tea on yield and yield attributes**

**Number of bolls plant$^{-1}$**

Data regarding number of bolls plant$^{-1}$ were recorded at 30, 90 and 120 DAS are presented in Table 2. It is evident from the results that the number of bolls plant$^{-1}$ was significantly affected due to the application of compost tea at different growth stages of crop and it was increased with advanced stage. In the treatment $T_2$ – 100% RDF the maximum number of bolls plant$^{-1}$ was recorded at flowering stage (24.33), boll formation stage (32.77) and at harvesting stage (43.77), this was at par with the treatment $T_4$ – (75 % RDF + @ 75 % CTF at 30, 75 and 120 DAS) at boll formation stage (29.40) and at harvesting stage (40.93). Whereas the minimum number of bolls plant$^{-1}$ was observed with the treatments $T_1$ – control at flowering stage (13.80), boll formation stage (21.50) and at harvesting stage (26.67) of cotton. The remaining treatments were statistically superior over the control. Adequate nutrient availability from the recommended dose of fertilizer can enhance the photosynthesis process in cotton plants. This, in turn, leads to better energy production and utilization, increasing boll production and larger boll size. This might also be due to the increased cell membrane permeability to nutrients, promoting the plant development in compost tea treated plots. The similar result was quoted by Basbag (2008), who reported that application of humic acid through seed soaking and foliar application increased the number of bolls plant$^{-1}$ due to increased vegetative production and enhanced plant water and nutrition absorption capacity.

**Mean boll weight (g boll$^{-1}$)**

Data regarding mean boll weight plant$^{-1}$ were recorded at 120 DAS are presented in Table 2. It is evident from the results that the mean boll weight plant$^{-1}$ was significantly affected due to the application of compost tea. In the treatment $T_2$ – 100% RDF significantly maximum mean boll weight plant$^{-1}$ was noticed at harvesting stage (4.47 g) which was at par with treatment $T_4$ – (75 % RDF + @ 75 % CTF at 30, 75 and 120 DAS) (4.31 g), $T_3$ – (75 % RDF + @ 50 % CTF at 30, 75 and 120 DAS) and $T_5$ – (75 % RDF + @ 25 % CTS at 30 and 45 DAS) and these treatments were found significantly superior over the rest of the treatments. Whereas the minimum mean boll weight plant$^{-1}$ was observed in treatment $T_1$ – control i.e. 3.16 g of boll weight. The increased boll weight might be attributed due to adequate fertilization along with compost tea application that enhances the photosynthetic capacity of cotton plants. This, in turn, leads to better energy production and utilization, resulting in increased boll production and larger boll size. The above results are in agreement with those of Zewail and Ahmed (2015). They reported an increase in plant height and mean boll weight (5.3g) by using PGPR+ Biosoal+ Compost tea, it could be attributed due to the presence of group of beneficial bacteria, which stimulated plant growth and increased crop yield.

**Dry matter production (kg ha$^{-1}$)**

Data regarding the dry matter production were recorded at the harvesting stage of the crop and are presented in Table 2. It was evident from the results that the dry matter production was significantly influenced by the application of compost tea. Significantly maximum dry matter production was observed in treatment $T_2$ (100% RDF) (4782.23 kg ha$^{-1}$) when compared with the rest of the treatments and control. Whereas the minimum dry matter production was observed with treatment $T_1$ – control (2468.70 kg ha$^{-1}$) but other treatments were found significantly superior to it. However, the resultant treatment $T_2$ was statistically at par with the treatment $T_4$ – (75 % RDF + @ 75 % CTF at 30, 75, and 120 DAS) with 4416.06 kg ha$^{-1}$. The per cent increase in dry matter over control was maximum in treatment $T_2$ – 100% RDF (93.71 %) followed by treatment $T_4$ – 75 % RDF + @ 75 % CTF at 30, 75, and 120 DAS (78.88 %) and minimum in treatment $T_7$ – 25 % RDF + @ 75 % CTS (18.08 %). The 100% recommended dose of fertilizer provides cotton plants with a full and balanced supply of essential nutrients, including nitrogen, phosphorus, and potassium, among others. When all necessary nutrients are readily available, the cotton plants can optimize their dry matter accumulation. Whereas in compost tea treated plots increased dry matter might be due to the increased root, and shoot activity especially due to compost tea which is beneficial in freeing up nutrients in the soil leading to increased leaf area i.e. photosynthetic area and ultimately resulting in an increase in dry matter accumulation and yield. Similar findings were reported by Arsode *et al.* (2014), who found that when nutrients are applied to foliage, there is an improvement in the uptake, translocation, and synthesis of photosynthetic assimilates, which leads to an increase in a variety of plant growth characters, including plant height, leaf area, and total dry matter, which ultimately increases seed yield.

**Seed cotton yield (q ha$^{-1}$)**

The data on seed cotton yield (q ha$^{-1}$) as affected by the application of compost tea are presented in Table 2. The treatment $T_2$ – 100% RDF recorded significantly higher seed cotton yield (21.60 q ha$^{-1}$) than the rest of the treatments. Whereas the minimum seed cotton yield was observed with treatment $T_1$ – control (12.14 q ha$^{-1}$). The remaining treatments were also found significantly superior to the control. However, the resultant treatment $T_2$ showed at par results with the treatment $T_4$ – (75 % RDF + @ 75 % CTF at

**Table 1. Effect of compost tea on growth parameters**

| Treatments | Plant height (cm) | | | Leaf area (cm$^2$) | | | Chlorophyll content | |
|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 90 DAS | 120 DAS | 30 DAS | 90 DAS | 120 DAS | Flowering stage(mg g$^{-1}$) | Boll formation stage (mg g$^{-1}$) |
| $T_1$ – Absolute control | 15.72 | 57.63 | 94.40 | 69.15 | 118.86 | 73.93 | 1.60 | 2.19 |
| $T_2$ – 100 % RDF (150:75:75 NPK kg ha$^{-1}$ + S @ 25 kg ha$^{-1}$ | 21.53 | 89.78 | 133.80 | 102.79 | 147.91 | 96.67 | 2.11 | 2.72 |
| $T_3$ – 75 % RDF + @ 50 % CTF | 20.59 | 84.23 | 116.87 | 91.21 | 141.57 | 88.80 | 1.98 | 2.51 |
| $T_4$ – 75 % RDF + @ 75 % CTF | 20.86 | 88.64 | 125.33 | 98.23 | 146.41 | 91.15 | 2.00 | 2.57 |
| $T_5$ – 75 % RDF + @ 25 % CTS | 20.44 | 87.77 | 118.67 | 86.39 | 139.23 | 82.17 | 1.99 | 2.37 |
| $T_6$ – 50 % RDF + @ 50 % CTS | 20.18 | 76.80 | 115.73 | 85.51 | 135.88 | 81.61 | 1.78 | 2.27 |
| $T_7$ – 25 % RDF + @ 75 % CTS | 19.07 | 70.24 | **112.67** | 70.73 | 134.29 | 76.69 | 1.63 | 2.25 |
| **SE m ±** | 1.12 | 6.05 | 2.73 | 9.29 | 3.60 | 4.75 | 0.09 | 0.12 |
| **CD at 5 %** | - | 18.15 | 8.18 | - | 10.70 | - | 0.27 | 0.36 |

**Table 2. Effect of compost tea on yield, yield attributes and B:C ratio**

| Treatments | Number of bolls plant$^{-1}$ | | | Mean boll weight (g boll$^{-1}$) | Dry matter (kg ha$^{-1}$) | Yield of cotton ( q ha$^{-1}$) | Percentage increase of yield over control | B:C Ratio |
|---|---|---|---|---|---|---|---|---|
| | Flowering stage | Boll formation stage | At Harvest | | | | | |
| $T_1$ – Absolute control | 13.80 | 21.50 | 26.27 | 3.16 | 2468.70 | 12.14 | - | 1.37 |
| $T_2$ – 100 % RDF (150:75:75 NPK kg ha$^{-1}$ + S @ 25 kg ha$^{-1}$ | 24.33 | 32.77 | 41.17 | 4.47 | 4782.23 | 21.60 | 77.9 | 1.71 |
| $T_3$ – 75 % RDF + @ 50 % CTF | 18.49 | 25.77 | 34.07 | 4.16 | 4142.67 | 20.22 | 66.5 | 1.57 |
| $T_4$ – 75 % RDF + @ 75 % CTF | 18.53 | 29.40 | 40.93 | 4.31 | 4416.06 | 20.92 | 72.3 | 1.60 |
| $T_5$ – 75 % RDF + @ 25 % CTS | 18.20 | 24.27 | 33.40 | 3.80 | 3862.13 | 20.22 | 66.5 | 1.59 |
| $T_6$ – 50 % RDF + @ 50 % CTS | 16.93 | 22.47 | 31.23 | 3.36 | 3488.94 | 17.64 | 45.3 | 1.50 |
| $T_7$ – 25 % RDF + @ 75 % CTS | 14.07 | 22.27 | 29.34 | 3.27 | 3017.10 | 15.45 | 17.5 | 1.41 |
| **SE m ±** | 1.21 | 1.34 | 2.46 | 0.25 | 149.58 | 1.76 | - | - |
| **CD at 5 %** | 3.64 | 4.03 | 7.40 | 0.75 | 448.74 | 5.26 | - | - |

CTF : Compost tea foliar spray at 30, 75 and 120 DAS
CTS : Compost tea soil trenching at 30 and 45 DAS

30, 75 and 120 DAS) 20.92 q $ha^{-1}$, $T_3$ – (75 % RDF + @ 50 % CTF at 30, 75 and 120 DAS) with 20.22 q $ha^{-1}$, $T_5$ – (75 % RDF + @ 25 % CTS at 30 and 45 DAS) with 3.80 q $ha^{-1}$ and $T_6$ – (50 % RDF + @ 50 % CTS) with 3.36 q $ha^{-1}$. The per cent increase in yield over control was maximum in $T_2$ – 100% RDF (77.90 %) followed by treatment $T_4$ – 75 % RDF + @ 75 % CTF at 30, 75 and 120 DAS (72.30 %) and minimum in treatment $T_7$ – 25 % RDF + @ 75 % CTS (17.50 %). This data clearly indicates that the application of compost tea reduced the 25 % RDF in combination with 5 % yield reduction over 100 % RDF. This might be attributed to the fact that provision of a sufficient supply of all three essential primary nutrients: nitrogen (N), phosphorus (P), and potassium (K). These nutrients are crucial for plant growth, and having the right balance of them in the 100% RDF treatment led to the best outcome in terms of yield. Increased yield due to the application of compost tea can be correlated with direct and indirect positive effects on plant growth, nutrient availability and hormone content which, in turn, diverts more photo-assimilates towards a higher number of sinks. Similar findings were reported by Basbag (2008). They reported that application of humic acid through seed soaking and foliar application increased the number of bolls $plant^{-1}$, sympodial branches, and seed cotton yield to the extent of 2868 kg $ha^{-1}$.

**B:C ratio**

The data regarding influence of application of compost tea on cotton crop are presented in Table 2. Data showed that the highest gross returns noticed with treatment $T_2$ followed by $T_4$>$T_5$>$T_3$. The benefit cost ratio varied from Rs 1.37 to 1.71. The highest benefit cost ratio observed in treatment $T_2$ – 100 % RDF (1.71) followed by $T_4$ – 75 % RDF + @ 75 % CTF (1.60), $T_5$ – 75 % RDF + @ 25 % CTS (1.59), $T_3$ – 75 % RDF + @ 50 % CTF (1.57) and minimum ratio was observed in treatment $T_1$ – Absolute control (1.37). In contrast, other remaining treatments showed high benefit-cost ratio compared with control treatment. The data clearly indicates that the foliar application and drenching methods of compost tea reduced the 25 % RDF and maintains the optimum yield and nutrient balance in soil. The above results are similar with those of Dwivedi *et al.* (2014), who reported that foliar spray of seaweed extracts the highest net return (25,244 $ha^{-1}$) and B: C ratio (1.27) was observed with the application of 15% Kappaphycus sap + recommended dose of fertilizer RDF.

The maximum growth parameters and yield attributes were recorded in 100% RDF applied treatments which was at par with 75 % RDF + @ 75 % CTF treated plots. In comparison to 100% RDF, the foliar application of compost tea decreased the 25% RDF and maintained the optimal yield with an accepted drop of 5% yield and 0.1% B:C ratio. It also helped to lower the usage of chemical fertilisers and preserve ecological sustainability.

# REFERENCES


Arsode, S.V., R.D. Deotale, P.P. Sawant, A.N. Sahane, and A.D.Baginwar, 2014. Influence of foliar spray of humic acid through cow dung wash and NAA on morpho-physiological parameters, growth and yield of Mustard, J. Soils and Crops. **24** (1): 112-119.

Basbag, S. 2008. Effects of humic acid application on yield and quality of cotton (*Gossypium hirsutum* L.). Asian J. Chem. **20**(3) : 1961-1966.

Dwivedi, S. K., M. R. Meshram, A. Pal, N. Pandey and A. Ghosh, 2014. Impact of natural organic fertilizer (seaweed saps) on productivity and nutrient status of black gram (Phaseolus mungo L.), The Bioscan, **9**(4): 1535-1539.

Ghuddhe, G.A., R.D.Deotale, S.B.Karade, O.G. Thakare, A.B. Dhangade and N.D. Jadhav 2019. Effect of foliar application of humic acid through vermicompost wash and NAA on morpho-physiological parameter and yield of sesamum. J. Soils and Crops **29** (1) : 105-111.

Naidu, Y., S. Meon and Y. Siddiqui, 2013. Foliar application of microbial enriched compost tea enhances growth, yield and quality of muskmelon *(Cucumis melo)* cultivated under a fertigation system. Scientia Horticulturae, **159**: 33–40.

Padghan, G.A., R.D. Deotale, V.S. Jayde, N.A. Mohurle, and S.D.Meshram, 2018. Response of humic acid and NAA on morpho-physiological and yield attributes of pigeon pea. J. Soils and Crops. **28** (1) : 108-114.

Piper, C. S. 1966 Soil and Plant Analysis, Hans Publishers, Bombay

Swain, T. and Hillis, W. E. 1959. The phenolic constituents of Prunusdomestical.The quantitative analysis of phenolic constituents. J. Sci. the Food and Agric. **10** : 63-68.

Temýz, M., E. Karahan, and Y.K. Koca, 2009. Effects of humic substances on cotton (Gossypium hirsutum L.). Asian J. Chem. **21**(3): 1983-1989.

Zewail, R. M. Y. and H. S. A. Ahmed, 2015. Effect of some biofertilizers (pgpr, biosoal and compost tea) on growth, yield, fiber quality and yarn properties of egyptian cotton. (promising hybrid 10229xg86). Annals Agric. Sci. Moshtohor, **53**(2): 199-210.


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