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EFFECT OF FOLIAR SPRAYS OF HUMIC ACID THROUGH VERMICOMPOST WASH AND NAA ON MORPHO-PHYSIOLOGICAL PARAMETERS, YIELD AND YIELD CONTRIBUTING PARAMETERS OF CHICKPEA

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ABSTRACT

The present investigation was undertaken during year *rabi* 2012-13 to study the effect of foliar sprays of humic acid through vermicompost wash and NAA on growth, yield contributing parameters of chickpea.The experiment was laid out in RBD with three replications comprising of different doses of humic acid through vermicompost wash and NAA. Spraying of humic acid and NAA was done at 25 and 40 DAS.The different treatments tested were 25 and 50 ppm NAA and 300 ppm, 400 and 500 ppm HA through VCW alone or in combination. One control (water spray) treatment was also taken during experimentation. Foliar sprays of 50 ppm NAA+400 ppm HA through VCW followed by 50 ppm NAA+300 ppm HA through VCW significantly enhanced the plant height, number of branches, leaf area, total dry matter production plant^{-1}, RGR,NAR, number of pods plant^{-1}, 100 seed weight (g) and seed yield ha^{-1}.

(Key words: Chickpea, vermicompost wash, NAA, morpho-physiological and growth parameters)

INTRODUCTION

Chickpea is important pulse crop in the world and it ranks third position. The important gram growing countries in the world are India, Turkey, Pakistan, Iran, Canada, Russia and Morocco. India ranks first in the world in respect of production as well as acreage followed by Pakistan. The largest gram producing states in India with respect to area are Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Rajasthan, Haryana and Karnataka. In Maharashtra chickpea ranks second next to pigeonpea in the production and productivity.

In India area under chickpea crop during 2011-12 was 83.20 million hectares with the production of 75.80 million tonnes having productivity of yield was 912 kg ha^{-1} (Anonymous a, 2012). In Maharashtra total area under chickpea cultivation during the year 2011-12 was 10.51 million hectares with the production of 8.14 million tonnes having average productivity of 775 kg ha^{-1} (Anonymous b, 2012). In Maharashtra Vidharbha region contributes major share in area as well as production of chickpea. In Vidharbha total area under chickpea was 3.98 million hectares with a total production of about 3.10 million tonnes having productivity of 775 kg ha^{-1} during the year 2011-12 (Anonymous c, 2012).

Humic acid (HA) when externally supplied was observed to increase crop growth and ultimately the yield. It improves the nutritional status of soil and plant system. Humic acid (HA) application had definite input on protein synthesis and nucleic acid synthesis.

The high cation exchange capacity of humic acid prevents nutrients from leaching. It absorbs the nutrients from chemical fertilizers and these exchanged nutrients are slowly released to the plant. Humic acid is the product of breakdown of organic matter. Humic acid proved many binding sites for nutrient such as calcium, iron, potassium and phosphorus. These nutrients are stored in humic acid molecule in a form readily available to plant and are released when the plants require them, humic acid increases the absorption and translocation of nutrients in plant and ultimately influences yield. Humic acid supply polyphenols that catalyze plant respiration and increases plant growth.

Vermicompost wash is useful as foliar spray. It is transparent pale yellow biofertilizer. It is a mixture of excretory products and mucous secretion of earth worm (*Lampito mautrii* and *Eisenia fetida*) and organic micronutrients of soil, which may be promoted as "potent fertilizer" for better yield and growth (Shweta *et al*., 2005). Vermicompost wash is having approximately 1300 ppm humic acid, 116 ppm dissolve oxygen, 50 ppm inorganic phosphate, 168 ppm potassium and 121 ppm sodium (Haripriya and Pookodi, 2005). Vermicompost wash is having N-0.29%, P-0.042%, K-0.143%, Ca-0.186%, Mg-0.11%, S-0.058%, Fe 0. 466 ppm, Mn 0.406 ppm, Zn 0.11 ppm, Cu 0.18 ppm. (Anonymous, 2007).

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NAA (Naphthalene Acetic Acid) is the synthetic auxin with the identical properties to that naturally occuring auxin. It prevents formation of abscission layer and thereby flower drop. It was observed that the growth regulators are involved in the direct transport of assimilates from source to sink (Sharma *et al.,* 1989). Considering the above facts present investigation was undertaken to see the effect of foliar sprays of humic acid through vermicompost wash and NAA on growth, yield and yield contributing parameters of chickpea.

MATERIALS AND METHODS

The present investigation on the effect of foliar sprays of humic acid through vermicompost wash and NAA on growth, yield contributing parameters of chickpea was conducted in field trial of experimental farm of Agril. Botany Section, College of Agriculture, Nagpur during 2012-13. The treatments of 25 and 50 ppm NAA and 300 ppm, 400 and 500 ppm HA through VCW alone or in combination like T_2 (25 ppm NAA), T_3 (50 ppm NAA), T_4(300 ppm HA through VCW), T_5 (400 ppm HA through VCW)), T_6(500 ppm HA through VCW), T_7 (25 ppm NAA+300 ppm HA through VCW), T_8 (25 ppm NAA+400 ppm HA through VCW), T_9 (25 ppm NAA+500 ppm HA through VCW), T_{10} (50 ppm NAA+300 ppm HA through VCW), T_{11} (50 ppm NAA+400 ppm HA through VCW) and T_{12} (50 ppm NAA+500 ppm HA through VCW) were tested with control (T_1). Chickpea seed variety Jaki-9218 was used for experiment *rabi* 2012-13. Observations on growth, yield contributing parameters of chickpea were also recorded. Plant height (cm), number of branches plant^{-1}, leaf area and total dry matter production plant^{-1} were recorded at 45, 65 and 85 DAS. Similarly RGR and NAR were calculated at 45-65 and 65-85 DAS. Observations on number of pods plant^{-1},100 seed weight and seed yield ha^{-1} were also recorded.

RESULTS AND DISCUSSION

Morpho – physiological parameters :
Plant height (cm) :

Data regarding plant height were recorded at three observational stages viz., 45, 65, and 85 DAS and are presented in table 1. At 45 DAS significantly highest plant height was recorded in treatment T_{11} (50 ppm NAA+400 ppm HA through VCW) followed by treatments T_{10}(50 ppm NAA + 300 ppm HA through VCW), T_8 (25 ppm NAA+400 ppm HA through VCW), T_7 (25 ppm NAA+300 ppm HA through VCW), T_5 (400 ppm HA through VCM),T_4 (300 pm HA through VCW), T_3 (50 ppm NAA), T_{12} (50 ppm NAA+500 ppm HA through VCW), T_9 (25 ppm NAA + 500 ppm HA through VCW) and T_6 (500 ppm HA through VCW). All the treatments were significantly superior over treatments T_1 (control) and T_2 (25 ppm NAA).

At 65 DAS plant height was significantly influenced by different treatments. At this stage treatment T_{11} (50 ppm NAA+400 ppm HA through VCW) showed significantly maximum plant height followed by treatments T_{10} (50 ppm NAA+300 ppm HA through VCW), T_8 (25 ppm NAA + 400 ppm HA through VCW), T_5 (400 ppm HA through VCW), T_7 (25 ppm NAA+300 ppm HA through VCW) and T_4(300 ppm HA through VCW). Treatments T_3 (50ppm NAA), T_{12} (50 ppm NAA + 500 ppm HA through VCW), T_9 (25 ppm NAA + 500 ppm HA through VCW), T_6 (500 ppm HA through VCW) and T_2 (25 ppm NAA) not influenced plant height at this stage and remained at par with T_1 (control).

The data recorded about plant height was statistically significant at 85 DAS. Significantly highest plant height was recorded in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW), followed by treatments T_{10} (50 NAA + 300 ppm HA through VCW), T_8 (25 ppm NAA + 400 ppm HA through VCW), T_7 (25 ppm NAA + 300 ppm HA through VCW), T_5(400 ppm HA through VCW), T_4 (300 ppm HA through VCW),T_3 (50 ppm NAA), T_{12} (50 ppm NAA + 500 ppm HA through VCW) and T_9 (25 ppm NAA + 500 ppm HA through VCW) in a descending manner when compared with control and remaining treatments. Treatments T_6 (500 ppm HA through VCW) and T_2 (25 ppm NAA) were not influenced plant height and found at par with control (T_1).

The application of growth promotive substances increased the plant height and such effect was due to increased photosynthetic activity, enhancement in the mobilization of photosynthates

and change in the membrane permeability (Shukla *et al*., 1997). Foliar application enhances the absorption and transport of nutrients and growth regulators. Hence, it facilitates availability of nutrients and growth of the plant. The data revealed that plant height was increased with the age till its maturity. Gaikwad *et al.* (2012) observed that two foliar sprays of 400 ppm HA through VCW increased plant height in maize.

Leaf area of plant :

Data regarding leaf area were recorded at three growth stages i.e. 45, 65 and 85 DAS. The data are given in table 1. At 45 DAS significantly maximum leaf area noticed in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatments T_{10} (50 ppm NAA + 300 ppm HA through VCW), T_8 (25 ppm NAA + 400 ppm HA through VCW),T_7 (25 ppm NAA + 300 ppm HA through VCW),T_5 (40 ppm HA through VCW), T_4 (300 ppm HA through VCW), T_3 (500 ppm NAA) and T_{12} (50 ppm NAA + 500 ppm HA through VCW) when compared with treatment T_1 (control) and rest of the treatments under study. The treatment T_9 (25 ppm NAA + 500 ppm HA through VCW), T_6 (500 ppm HA through VCW), T_2 (25 ppm NAA) could not achieved more leaf area at this stage and these treatments were found at par with treatment T_1 (control).

At 65 and 85 DAS leaf area plant^{-1} was significantly influenced by different treatments. At this stage treatments T_{11} (50 ppm NAA + 400 ppm HA through VCW),T_{10} (50 ppm NAA + 300 ppm HA through VCW),T_8 (25 ppm NAA + 400 ppm HA through VCW), T_7 (25 ppm NAA + 300 ppm HA through VCW), T_5 (400 ppm HA through VCW), T_4 (300 ppm HA through VCW), T_3 (50 ppm NAA) and T_{12} (50 ppm NAA + 500 ppm HA through VCW) recorded significantly maximum leaf area in a descending manner. Treatments T_9 (25 ppm NAA + 500 ppm HA through VCW), T_6 (500 ppm HA through VCW) and T_2 (25 ppm NAA) unable to show their superiority over treatment T_1 (Control).

Gaikwad *et al.* (2012) suggests that foliar sprays of 400 ppm followed by 350 ppm HA increased leaf area plant^{-1} over control in maize. Deotale *et al.* (2011) investigated the effect of two foliar sprays of different concentrations of NAA (50 ppm) and cow urine (2, 4, and 6%) at 25 and 40 DAS on soybean cultivar JS 335.Considering the concentrations 6% cow urine spray and 50 ppm NAA alone and in combinations were found more effective in enhancing the leaf area, when compared with control.

Total dry matter production plant^{-1} :

Data pertaining to the dry matter plant^{-1} recorded at different stages are presented in table 1. Significantly maximum dry matter was noticed in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatments T_{10} (50 ppm NAA + 300 ppm HA through VCW) and T_8 (25 ppm NAA + 400 ppm HA through VCW) when compared with control and rest of the treatments under observations. Similarly treatmentsT_7 (25 ppm NAA + 300 ppm HA through VCW), T_5 (400 ppm HA through VCW), T_4 (300 ppm HA through VCW), and T_3 (500 ppm NAA) also gave significantly more dry matter in a descending manner when compare with treatment T_1 (control) and other remaining treatments. Treatments T_{12} (50 ppm NAA + 500 ppm HA through VCW), T_9 (25 ppm NAA + 500 ppm HA through VCW), T_6 (500 ppm HA trough VCW) and T_2 (25 ppm NAA) were found at par with treatment T_1 (control).

The data recorded about the dry matter production were statistically significant at 65 and 85 DAS. Significantly highest dry matter was recorded in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW), treatments T_{10} (50 ppm NAA + 300 ppm HA through VCW) and T_8 (25 ppm NAA + 400 ppm HA through VCW) also recorded more dry matter when compared with control and rest of the treatments under study. Treatments T_7 (25 ppm NAA + 300 ppm HA through VCW), T_5 (400 ppm HA through VCW), T_4 (500 ppm HA through VCW), T_3 (50 ppm NAA), T_{12} (50 ppm NAA + 500 ppm HA through VCW) also recorded more dry matter production when compared with control and rest of the treatments under observations. Similarly treatments T_6 (25 ppm NAA + 500 ppm HA through VCW) and T_2 (25 ppm NAA) also gave significantly more dry matter when compared with treatment T_1 (control). One of the reasons for low productivity in pulses is due to poor source-sink relationship. In an attempt to see the foliar sprays of HA through VCW and NAA in the

present study it was found that there was a significant increase in the dry matter production and its distribution in different plant parts viz., leaf, stem and reproductive parts due to the application of humic acid through vermicompost wash and NAA in combination or alone on chickpea. Celk *et al*. (2011) studied the effect of foliar application of humic acid on dry matter accumulation of maize grown under calcareous soil condition. Three foliar application doses of humic acid (0, 0.1 and 0.2%) sprayed at 20 and 35 days after emergence. Foliar application of humic acid had a statistically significant and positive effect on dry weight of maize. Deotale *et al.* (2010) reported the effectivity of foliar sprays of 2-6% cow urine and 50 ppm NAA on morpho-physiological parameters of black gram. Data revealed that foliar application of 6% cow urine +50 ppm NAA significantly increased total dry matter of black gram.

Growth analysis :

Growth analysis is one of the measures for accessing the seed yield of plant. The physiological basis of yield difference can measured through an evaluation of difference in growth parameters and their impact on yield. The productivity of crop may be related with the parameters such as RGR, NAR and partitioning of total photosynthate into economic and non-economic sink.

Relative growth rate :

The highest rate of RGR indicates the ability of maximum dry matter for development. The increment in RGR might be associated with maximum leaf area expansion and growth of stem and root. Data regarding RGR are given in table 2. At 45 – 65 DAS all the treatments gave significant variation in respect of RGR when compared with control. Significantly maximum RGR was observed in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatments T_{10} (50 ppm NAA + 300 ppm HA through VCW), T_8 (25 ppm NAA + 400 ppm HA through VCW) and T_7 (25 ppm NAA + 300 ppm HA through VCW) when compared with other treatments under observations. Similarly treatments T_5 (400 ppm HA through VCW), T_4 (300 ppm HA through VCW), T_3 (50 ppm NAA) and T_{12} (50 ppm NAA + 500 ppm HA through VCW) recorded moderate RGR in a descending manner. Treatments T_9 (25 ppm NAA + 500 ppm HA through VCW), T_2 (25 ppm NAA) and T_6 (500 ppm HA through VCW) were found at par with the T_1 (control). At 65 – 85 DAS all the treatments gave significant variation in respect of RGR when compared with control. Significantly more RGR was noticed in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatments T_{10} (50 ppm NAA + 300 ppm HA through VCW), T_7 (25 ppm NAA + 300 ppm HA through VCW), T_8 (50 ppm NAA + 300 ppm HA through VCW), T_5 (400 ppm HA through VCW), and T_9 (25 ppm NAA + 500 ppm HA) in a descending manner when compared with treatment control and rest of the treatments. Treatments T_3 (50 ppm NAA), T_4 (300 ppm HA through VCW), T_2 (25 ppm NAA), T_6 (500 ppm HA through VCW), and T_{12} (50 ppm NAA + 500 ppm HA through VCW) were found at par with treatment T_1 (control).

Gaikwad *et al.* (2012) carried out an experiment in randomized block design with three replications comprising of different doses of humic acid through vermicompost wash. Spraying of humic acid was done at 20 and 40 DAS. The different treatments tested were control, 100, 150, 200, 250, 300, 400, 450, 500 ppm humic acid. Foliar sprays of humic acid showed their significance over control. Foliar sprays of 400 ppm followed by 350 ppm humic acid increased RGR.

Net assimilation rate :

NAR is closely connected with photosynthetic efficiency of leaves, but it is not a pure measure of photosynthesis. Increment in NAR is related with the increase in total dry weight of plant unit^{-1} of leaf area. NAR depends upon the excess dry matter gained, over the loss in respiration. It is increase in plant dry weight unit^{-1} area of assimilatory tissues unit^{-1} time. Data regarding NAR are given in table 2.

At 45 – 65 DAS NAR was significantly maximum in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatment T_{10} (50 ppm NAA + 300 ppm HA through VCW). Similarly treatments T_8 (25 ppm NAA + 400 ppm HA through VCW) and T_7 (25 ppm NAA + 300 ppm HA through VCW) also recorded more NAR as compared to treatment T_1 (control) and rest of the treatments under observations. Treatments T_5 (400 ppm HA through VCW), T_4 (300 ppm HA through VCW), T_3 (50 ppm

NAA), T_{12} (50 ppm NAA + 500 ppm HA through VCW) and T_9 (25 ppm NAA + 500 ppm HA through VCW) recorded moderate NAR in a descending manner. But treatments T_6 (500 pm HA through VCW) and T_2 (25 ppm NAA) were found at par with treatment T_1 (control). At 65 – 85 DAS NAR was significantly maximum in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatment T_{10} (50 ppm NAA + 300 ppm HA through VCW) compared to treatment T_1 (control) and rest of the treatments under observations. Treatments T_8 (25 ppm NAA + 400 ppm HA through VCW), T_7 (25 ppm NAA + 300 ppm HA through VCW) and T_5 (400 ppm HA through VCW) also recorded more NAR as compared to treatment T_1 (control) and rest of the treatments under observations. Similarly treatments T_4 (300 ppm HA through VCW), T_3 (50 ppm NAA), T_{12} (50 ppm NAA + 500 ppm HA through), T_9 (25 ppm NAA + 500 ppm HA through VCW) and T_2 (25 ppm NAA) recorded moderate NAR in a descending manner. Treatment T_6 (500 pm HA through VCW) was also found at par with treatment T_1 (control).

Ingle (2007) tried foliar application of 50 ppm NAA and 2, 4 and 6% cow urine on black gram and found that 6% cow urine + 500 ppm NAA increased NAR over control. Hiradeve (2010) carried out a field experiment to study the physiological response of groundnut to foliar sprays of different concentrations of vermicompost leachate. HA applied with different concentrations at 20 and 35 DAS significantly enhanced NAR.

Yield and yield contributing parameters :

Yield is complex character determined by several traits internal plant processes and environmental factors. In present study data on effect of humic acid sources i.e. VCW and NAA on number of pods plant^{-1}, 100 seed weight and seed yield ha^{-1} are presented in table 2.

Number of pods plant^{-1}, 100 seed weight and seed yield ha^{-1} :

Significantly maximum number of pods plant^{-1}, 100 seed weight and seed yield ha^{-1} were recorded in treatment T_{11} (50 ppm NAA + 400 ppm HA through VCW) followed by treatments T_{10} (50 ppm NAA + 300 ppm HA through VCW), T_8 (25 ppm NAA + 400 ppm HA through VCW), T_7 (25 ppm NAA + 300 ppm HA through VCW), T_5 (400 ppm HA through VCW), T_4 (300 ppm HA through VCW), T_3 (50 ppm NAA) and T_{12} (50 ppm NAA + 500 ppm HA through VCW) in a descending manner when compared with control and rest of the treatments. While, treatments, T_9 (25 ppm NAA + 500 ppm HA through VCW), T_6 (500 ppm HA through VCW) and T_2 (25 ppm NAA) were found at par with T_1 (control).

Hu and Wang (2001) studied the effect of Komix, humic acid containing organic fertilizer on spring soybean, Komix significantly increased yield, seeds plant^{-1}, pods seed weight plant^{-1} and 100 seed weight of spring soybean. Gaikwad *et al.* (2012) observed that the foliar sprays of 400 ppm followed by 350 ppm humic acid increased the 100 grain weight (g) in maize.

Table 1. Effect of humic acid through vermicompost wash and NAA on morpho - physiological parameters of chickpea

Treatments	Plant height (cm)			Number of branches plant^{-1}			Leaf area plant^{-1} (dm^2)			Total dry matter production plant^{-1} (g)		
	45 DAS	65 DAS	85 DAS	45 DAS	65 DAS	85 DAS	45 DAS	65 DAS	85 DAS	45 DAS	65 DAS	85 DAS
T_1 (Control)	29.88	43.20	49.38	2.40	3.60	3.63	1.03	1.30	1.40	0.75	1.42	2.00
T_2 (25 ppm NAA)	30.28	44.20	50.20	2.45	3.67	3.69	1.05	1.34	1.48	0.75	1.48	2.10
T_3 (50 ppm NAA)	37.70	46.60	51.90	2.67	3.95	3.97	1.27	1.58	1.80	0.94	2.26	3.23
T_4 (300 ppm HA)	31.81	47.40	52.03	2.70	4.00	4.02	1.29	1.59	1.85	0.96	2.35	3.35
T_5 (400 ppm HA)	32.20	49.50	53.91	2.73	4.17	4.21	1.32	1.63	1.88	1.01	2.68	3.85
T_6 (500 ppm HA)	31.41	44.73	50.23	2.47	3.81	3.90	1.12	1.40	1.56	0.82	1.58	2.20
T_7 (25 ppm NAA+ 300 ppm HA)	32.50	49.04	54.22	2.76	4.20	4.26	1.35	1.66	1.90	1.03	2.95	4.24
T_8 (25 ppm NAA+ 400 ppm HA)	32.67	50.50	54.60	2.80	4.24	4.29	1.37	1.69	1.93	1.11	3.20	4.60
T_9 (25 ppm NAA+ 500 ppm HA)	31.44	45.30	50.51	2.50	3.89	3.93	1.17	1.45	1.64	0.86	1.78	2.50
T_{10} (50 ppm NAA+ 300 ppm HA)	32.71	50.80	54.90	2.85	4.31	4.36	1.38	1.71	1.94	1.11	3.36	4.86
T_{11} (50 ppm NAA+ 400 ppm HA)	32.82	50.91	55.22	2.93	4.60	4.65	1.41	1.75	1.99	1.20	3.78	5.48
T_{12} (50 ppm NAA+ 500 ppm HA)	31.60	46.00	51.70	2.53	3.93	3.97	1.24	1.52	1.72	0.91	2.05	2.90
SE (m)±	0.589	1.370	1.318	0.09	0.14	0.12	0.077	0.08	0.110	0.038	0.112	0.174
CD at 5%	1.728	4.018	3.867	0.26	0.42	0.35	0.226	0.25	0.324	0.112	0.330	0.511

(Note : Source of HA through vermicompost wash)

Table 2. Effect of humic acid through vermicompost wash and NAA on PGR, NAR and yield and yield contributing parameters of chickpea

Treatments	RGP g g^{-1} day		NAR g dm^{-2} day^{-1}		Yield contributing parameters		
	45-65 DAS	65-85 DAS	45-65 DAS	65-85 DAS	Number of pods $plant^{-1}$	100 seed weight (g)	Seed yield ha^{-1} (q)
T_1 (Control)	0.0319	0.01701	0.01258	0.00921	39.69	22.00	17.22
T_2 (25 ppm NAA)	0.0338	0.01749	0.01329	0.00982	39.74	22.10	18.16
T_3 (50 ppm NAA)	0.0437	0.01760	0.02018	0.01230	43.59	23.12	20.66
T_4 (300 ppm HA)	0.0449	0.01749	0.02113	0.01244	44.50	23.48	21.09
T_5 (400 ppm HA)	0.0480	0.01779	0.02449	0.01468	45.63	24.00	21.63
T_6 (500 ppm HA)	0.0328	0.01728	0.01332	0.00929	40.10	22.32	18.19
T_7 (25 ppm NAA+ 300 ppm HA)	0.0526	0.01808	0.02799	0.01581	46.40	24.65	21.99
T_8 (25 ppm NAA+ 400 ppm HA)	0.0530	0.01800	0.02983	0.01670	46.75	24.80	22.16
T_9 (25 ppm NAA+ 500 ppm HA)	0.0362	0.01779	0.01531	0.01048	40.77	22.55	19.33
T_{10}(50 ppm NAA+ 300 ppm HA)	0.0556	0.01839	0.03204	0.01792	47.31	25.00	22.43
T_{11}(50 ppm NAA+ 400 ppm HA)	0.0576	0.01854	0.03623	0.02027	47.72	25.80	22.59
T_{12}(50 ppm NAA+ 500 ppm HA)	0.0404	0.01718	0.01785	0.01164	41.90	22.80	19.86
SE (m)±	0.0028	0.00029	0.00151	0.00088	1.649	0.810	0.678
CD at 5%	0.0084	0.00087	0.00443	0.00260	4.836	2.376	1.990

(Note : Source of HA through vermicompost wash)

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