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Effect of different plant growth regulators on the yield of transplanted rice (*Oryza sativa* L.)

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Abstract
World population is increasing year by year. This increase in population increases their demand for food and thus we are forced to increase food production. So although there are various factors to increase the production of rice which is a food source but without plant growth regulators (PGR) it is not possible to increase the food production. So in this compilation we will increase the food production by using PGR. The treatments are T_1 - Gibberellic acid 40% WSG @ 10 gm ha^{-1},T_2 - Gibberellic acid 40% WSG @ 20 gm ha^{-1}, T_3 - Abscisic acid 20% SG @ 60 gm ha^{-1}, T_4 - Abscisic acid 20% SG @ 30 gm ha^{-1},T_5 - Humic acid 12% @ 12.5 l ha^{-1}, T_6 - Humic acid 12% @ 10 l ha^{-1}, T_7 - Triacontanol 0.05% EC @ 250 ml ha^{-1}, T_8 - Triacontanol 0.05% EC @ 150 ml ha^{-1}, T_9 - Untreated control. Growth regulators *viz.*, Gibberellic acid (GA_3), Humic acid, and Triacontanol were foliar sprayed at active tillering stage and Abscisic acid was foliar sprayed at early grain filling stage of crop growth. The result showed that foliar application of Humic acid 12% @ 12.5 l ha^{-1} (T_5) recorded the highest yield attributes *viz.*, Number of panicles m^{-2}, Number of grains $panicle^{-1}$, Thousand Grain weight (g) and yield of rice over the control.

Keywords: Annamalai, yield parameters, growth regulators, humic, acid, rice

1. Introduction
Rice (*Oryza sativa* L.), a crop that is widely grown all over the world, is known as the "global grain". It belongs to the Poaceae family and significantly influences the world's food and nutritional security. According to Madhukeshwera *et al.* (2018) [11], India's population will be near to 1.6 billion in 2050, up from 1.37 billion in 2020 (Worldometer, UN, 2020) [18]. India currently produces 291.95 million tonnes of food grain (cereals) (ET Bureau, 2019-2020) [3] and according to the Federation of Indian Chambers of Commerce and Industry, food grain demand in India will reach over 355 million tonnes in 2030. The demand for rice production has expanded as a result of the constantly growing population. Numerous elements, including the types of soil, fertilisers utilised, irrigation, planting genotypes, and various agronomic techniques, have an impact on the potential rice yield. Utilizing appropriate and modern technologies will help to boost rice productivity (Badwai, 2004) [2]. One significant example of more recent technology is the use of plant growth regulators on rice crops. It could be challenging to achieve considerable grain yields if PGR is not present at any stage of the plant (Pandey *et al.*, 2001) [14].

GA_3 is a great hormone for plant growth because it encourages cell elongation. In order to develop hybrid rice seeds with a high seed yield, GA_3 is essential. (Gavino *et al.*, 2008) [4]. Triacontanol is a non-toxic plant growth bio-regulator that helps seedlings grow into more robust plants with higher yields by fostering the development of stronger seedlings with healthier root systems. One of the most crucial stages in the development of cereals is the filling of rice grains since it directly affects the yield and ultimate grain weight (Kato *et al.*, 1993) [8]. A commercial substance called humic acid contains numerous components that enhance soil fertility, increase nutrient availability, and hence increase plant production. By enhancing plant development and yield, humic acid application resulted in a large increase in soil organic matter. Humic acid was added to transplanted rice to increase nutrient content and improve uptake of macro- and micronutrients (Govindasamy and Chandrasekaran, 2002) [7]. According to Kavitha *et al.* (2010) [9] humic acid administration through seedling dipping (0.3%) and twice-daily foliar application significantly increased rice yield and yield characteristics. Therefore, an experiment was conducted to find out the effect of plant growth regulators on yield attributes and yield of rice.

2. Materials and Methods

To investigate the effect of various plant growth regulators on the yield of transplanted rice, a field experiment was carried out at the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, and India from Navarai season (January-April, 2019). The soil was clayey, had a pH of 7.6, and had 235 kg/ha of accessible nitrogen, 17.80 kg/ha of phosphorus, and 320 kg/ha of exchangeable potassium. During the Navarai season CO 47 is the rice variety chosen for the study. Nine treatments and three replications were used in the Randomised Block Design (RBD) experiment. The details of the treatments were given below.

T_1 - Gibberellic acid 40% WSG @ 10 gm ha^{-1}
T_2 - Gibberellic acid 40% WSG @ 20 gm ha^{-1}
T_3 - Abscisic acid 20% SG @ 60 gm ha^{-1}
T_4 - Abscisic acid 20% SG @ 30 gm ha^{-1}
T_5 - Humic acid 12% @ 12.5 l ha^{-1}
T_6 - Humic acid 12% @ 10 l ha^{-1}
T_7 - Triacontanol 0.05% EC @ 250 ml ha^{-1}
T_8 - Triacontanol 0.05% EC @ 150 ml ha^{-1}
T_9 - Untreated control

At various stages of crop growth, growth regulators were applied topically. With a hand-operated knapsack sprayer, Gibberellic acid was applied during the active tillering stage, Abscisic acid at the early grain filling stage, and both Humic acid and Triacontanol were applied during the active tillering stage.

One square meter area was selected at random using 0.25 m^{-2} quadrat and ear bearing tillers alone were counted and recorded as number of panicles m^{-2}. The panicles were randomly chosen for recording number of grains $panicle^{-1}$. The differentiations of well filled and chaffy grains were made by pressing grains with finger and they were counted and recorded Number of grains $panicle^{-1}$. Thousand grain weight(g) was measured by Yoshida *et al*.,(1976) [19] method about One thousand grains were counted separately at harvest from each plot and their weight was recorded at 14 percent moisture level and expressed in gram. The matured crop was harvested from the net plot area and the grains were separated, cleaned and dried at 14 per cent moisture content and the grain yield was computed and recorded in kg ha^{-1}. After separating the grain, the left over straw of net plot was sundried and weighed. The straw yield was calculated and expressed in kg ha^{-1}. Biological yield was calculated by the summation of grain and straw yield and recorded in t ha^{-1}. Harvest index percentage was worked out by grain yield divided by biological yield and its multiplied with hundred. The data on various characters studied during the course of investigation were statistically analyzed as suggested by Gomez (1984) **[6]**. Whenever the results were significant, the critical difference was worked out at 5% probability level to draw statistical conclusions.

3. Results and Discussion

3.1. Number of panicles m^{-2}

The values on number of panicles m^{-2} at maturity stage of rice revealed that number of panicles m^{-2} was significantly influenced by application of plant growth regulators over the control (T_9) (Table 1). The number of panicles m^{-2} at maturity stage ranged from 306 to 369. On close examination of the data furnished in Table 1 showed that among different plant growth regulators, foliar application of humic acid 12% @ 12.5 l ha^{-1} (T_5) recorded significantly higher values of number of panicles m^{-2} of 369 at maturity stage of rice over rest of the treatments. This was followed by T_6 (Humic acid 12% @ 10 l ha^{-1}) and T_2 (Gibberellic acid 40% WSG @ 20 gm ha^{-1}) and the values were on par.

The least number of panicles $m^{-2}$of 306 was recorded under treatment T_9 (control) at maturity stage of rice. Number of productive tillers and fertile grains are known as primary yield components, which play an important role in yield formation (Gevrek *et al*., 2012) [5]. Tillers that produce panicle are called productive tillers. Number of tillers per plant has an indirect effect on yield, but it has a positive effect *via* number of panicles per plant (Adam and Jahan, 2011) [1]. In this regard, more number of effective tillers per plant was observed under foliar application of humic acid (Kavitha *et al.,* 2010) [9].

3.2. Number of grains $panicle^{-1}$

The result related to number of grain panicle-1 was significantly influenced by application of plant growth regulators over the control (T_9) (Table 1). The number of grain $panicle^{-1}$ ranged from 66.6 to 90.

Data on table 1 indicated that among different plant growth regulators, foliar application of humic acid 12% @ 12.5 l ha^{-1} (T_5) recorded the highest number of grain $panicle^{-1}$ of 90 and was significantly superior to rest of the treatments. Followed by, T_6 (Humic acid 12% @ 10 l ha^{-1}) and T_2 (Gibberellic acid 40% WSG @ 20 gm ha^{-1}).The least number of grain $panicle^{-1}$ of 66.6 was recorded under (T_9) control. In this regard number of grains $panicle^{-1}$ was observed under foliar application of humic acid (Kavitha *et al.,* 2010) [9].

3.3. Thousand Grain weight (g)

Table 1 showed that thousand grain weight of rice was not statistically significant by foliar application of different plant growth regulators. The weight of thousand grain depends on size and filling of grains. Also, 1000 grain weight is associated with the mobilization and translocation of assimilates from plant parts to developing grains (Adam and Jahan, 2011) [1]. But in this study the thousand grain weight of rice was not statistically significant by foliar application of different plant growth regulators and control. As it is a genetic character significant difference could not be found.

3.4. Yield

3.4.1. Grain yield (kg ha^{-1})

Grain yield was significantly influenced by foliar application of plant growth regulators over the control (T_9). Table 1 indicated that the yield values varied between 3325 - 5417 kg ha^{-1}. Among the various growth regulators, foliar application of Humic acid 12% @ 12.5 l ha^{-1} (T_5) recorded the highest grain yield of 5417 kg ha^{-1}. It was significantly superior to rest of the treatments. The least grain yield of 3325 kg ha^{-1} was recorded under treatment T_9 (control). Positive influence of yield attributes of the crop reflected significant results in the yield of rice crop (Pal *et al*., 2009) [13].

These findings are consistent with Osman *et al.,* (2013) [12], who also reported that more number of effective tillers and number of grains $panicle^{-1}$ are closely associated with high seed yield per plant resulted in higher productivity. Increased biomass resulted in higher yield (Przybysz *et al*., 2014) [15]. These were the reasons behind the increased yield.

3.4.2. Straw yield (kg ha^{-1})

On perusal of the data in Table 1 showed that foliar application of plant growth regulators significantly influenced the straw yield of rice as that of grain yield over the control (T_9) and it values varied between 5527 – 7609 kg ha^{-1}.

Among the various growth regulators, significantly higher straw yield of 7609 kg ha^{-1} was recorded in treatment receiving foliar application of Humic acid 12% @ 12.5 l ha^{-1} (T_5) and was superior to rest of the treatments. The least straw yield of 5527 kg ha^{-1} was recorded under treatment T_9 control. Kumar *et al*. (2017) [10] reported that straw yield was influenced by accumulation of dry matter. Osman *et al.,* (2013) [12] stated that foliar application of humic acid and fulvic acid together significantly increased the grain and straw yield. This was confirmed in the present study also.

Table 1: Effect of plant growth regulators on yield attributes and yield of rice

Treatments	Number of panicles m^{-2}	Number of filled grains per panicle	Test weight (g)	Grain yield (kg)	Straw yield (kg)	Harvest index
T1	342	80.9	18.6	4538	6846	39.9
T2	353	84.9	18.7	4927	7114	40.9
T3	315	71.6	18.6	3688	6059	37.8
T4	311	70.6	18.6	3543	5819	37.8
T5	369	90	18.8	5417	7609	41.6
T6	358	86.4	18.7	5095	7344	41.0
T7	337	79.7	18.6	4401	6596	40.0
T8	326	75.8	18.6	4139	6326	39.5
T9	306	66.6	18.5	3325	5527	37.6
S.Ed.	4.1	1.4	0.7	85	121	1.1
CD (P=0.05)	8.7	2.9	NS	181	258	NS

NS: Non Significant

3.5. Harvest index

The data on harvest index of rice was presented in the Table 1. The data on harvest index of rice was found not statistically significant among application of different plant growth regulators on rice during *Navarai* season.

4. Conclusions

According to the experimental findings, applying humic acid 12% @ 12.5 l ha^{-1} (T_5) boosted the yield characteristics and yield of rice. As a result, it was determined that applying humic acid at a rate of 12 percent at 12.5 litres per hectare (T_5) was a more effective method for growing rice in terms of agronomy, sustainability of the economy, and ecological viability.

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6. References

1. Adam AMMG, Jahan N. Effects of naphthalene acetic acid on yield attributes and yield of two varieties of rice (*Oryza sativa* L.). Bangladesh Journal of Botany. 2011;40(1):97-100.
2. Badawi A. Rice-based production systems for food security and poverty alleviation in the near-east and north Africa. New challenges and technological opportunities, Rome, Italy; c2004.
3. Economic Times. https://economictimes.indiatimes.com. Visited on 5 Jan, 2020.
4. Gavino RB, Pi Y, Abon CC. Application of gibberellic acid (GA_3) in dosages for three hybrid rice seed production in the Philippines. Journal of Agricultural Technology. 2008;4(1):183-192.
5. Gevrek MN, Atasoy GD, Yigit A. Growth and yield response of rice (*Oryza sativa*) to different seed coating agents. International Journal of Agricultural Biology. 2012;14(5):826–830.
6. Gomez KA, Gomez AA. Statistical produce for agriculture research. John Wiley and Sons, New York; c1984. p. 680.
7. Govindasamy R, Chandrasekaran S. Effect of graded levels of humicacid with and without N on the performance of lowland rice. In International seminar on recent trends on the use of humic substances for sustainable agriculture, Annamalai University, Tamil Nadu, India; c2002. p. 5.
8. Kato T, Naoki Sakurai, Sumu Kuraishi. The Changes of Endogenous Abscisic Acid in Developing Grain of Two Rice Cultivars with Different Grain Size. Japanese Journal of Crop Science. 1993;62(3):456-461.
9. Kavitha MP, Ganesaraja V, Paulpandi VK, Subramanian RB. Effect of age of seedlings, weed management practices and humic acid application on system of rice intensification. Indian Journal of Agricultural Research. 2010;44(4):294-299.
10. Kumar D, Singh AP, Raha P, Singh CM. Effects of potassium Humate and chemical fertilizers on growth, yield and quality of rice (*Oryza sativa* L.). Bangladesh Journal of Botany. 2014;43(2):183-189.
11. Madhukeshwara Puttappanavara B, Deshpande VK. Effect of GA_3 with organic and in-organic supplements in KRH-4 hybrid rice seed production. International Journal of Pure Applied Bioscience. 2018;6(4):728-732.
12. Osman EAM, El-Masry AA, Khatab KA. Effect of nitrogen fertilizer sources and foliar spray of humic and/or fulvic acids on yield and quality of rice plants. Advances Zinc Applied Science Research. 2013;4(4):174-183.
13. Pal D, Mallick S, Ghosh RK, Pal P, Tzudir L, Barui K. Efficacy of triacontanol on growth and yield of rice crop in inceptisol of west Bengal. Journal of Crop and Weed. 2009;5(2):128-130.
14. Pandey N, Upadhyay SK, Tripathi RS. Effect of plant growth regulators and fertility levels on growth and yield of transplanted rice. Indian Journal of Agricultural

Research. 2001;35(3):205-207.
15. Przybysz A, Gawronska H, Gajc-Wolska J. Biological mode of action of a nitrophenolates – based biostimulant: case study. Fronts Plant Science. 2014;5(713):1-14.
16. Tattini M, Bertoni P, Lanedi A, Traversim ML. Effect of humic acids on growth and biomass partitioning of container grown olive plants. Acta Horticultura. 1991;294:75-80.
17. US. Department of agriculture. Global Market Analysis, Foreign Agricultural service. https://www.fas.usda.gov/data/world agricultural product, Visited on 5 Jan, 2020.
18. Worldometer. United Nations, Department of Economic and social affairs, population Division. www.Worldometers.info. Visited on 5 Jan,2020.
19. Yoshida S, Farno DA, Cock JH, Gomez KA. Laboratory manual for physiological studies of rice**.** 3rd Edition, IRRI, Philippines; c1976. p. 7-76.