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EFFECT OF CHLORMEQUAT CHLORIDE AND MALEIC HYDRAZIDE ON MORPHO-PHYSIOLOGICAL AND YIELD PARAMETERS IN RICE (*Oryza sativa* L.)

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ABSTRACT

The field experiment on the response of chlormequat chloride and maleic hydrazide on morpho-physiological and yield parameters in rice was carried out at the Wetland farm of S.V. Agricultural College, Tirupati, Andhra Pradesh during *rabi*, 2020-21. The experiment was replicated thrice and laid out in a randomized block design with seven treatments differing in concentrations of Maleic hydrazide and Chlormequat chloride. Decreased plant height in addition to increased crop growth rate, harvest index, and no significant difference in the number of nodes on the main culm was noted with the application of plant regulating chemicals.

KEYWORDS: Maleic Hydrazide, Chlormequat Chloride, Crop Growth Rate, Harvest Index, Main Culm.

INTRODUCTION

Rice is the essential harvest in India, China, and different nations of South East Asia. Rice assumed a significant part in forming the societies and economies of millions of individuals. India has a differentiated rice environment compared with some other countries, and it possesses a broad history of rice development (Anonymous, 2016).

In India, and in particular Andhra Pradesh, unseasonably wet weather and floods in coastal habitats are typical occurrences. This is becoming increasingly pronounced as a result of recent climate change. When the standing mature crop becomes trapped in these untimely showers, it causes lodging and also leads to premature germination, which lowers the grain quality. The potential remedy to this problem is to incorporate dormancy into the non-dormant cultivars, as most popular rice cultivars in Andhra Pradesh are non-dormant (Anonymous, 2018). Dormancy is one of the mechanisms through which seeds remain viable in adverse settings.

Plant Growth Regulators (PGRs) are frequently employed in modern agriculture to improve plant growth, yield, and grain quality. In high-input cereal management, PGRs were used to shorten the stem and reduce lodging susceptibility. According to Rajala (2003), PGRs, are primarily intended to reduce stem elongation. Nevertheless, many studies believe that, regardless of their effect on stem height, PGRs can alter cereal growth patterns, resulting in higher grain yields. In light of this, the current study was conducted to investigate the impact of maleic hydrazide and chlormequat chloride on morphological, physiological, and yield parameters of rice.

MATERIAL AND METHODS

The field experiment took place during the *rabi* season of 2020-21 at the S.V. Agricultural College, wetland farm in Tirupati, which is located in the Southern Agro-Climatic Zone of Andhra Pradesh, India. The soil texture at the site was sandy clay loam, with a neutral soil reaction. The nursery beds were prepared with raised seed beds and rows. Seeds were sown in the lines and immediately covered with soil, followed by slight irrigation. Following the preparation of the main field, twenty one-day-old seedlings were transplanted at two seedlings per hill in the main field. The study used a randomized block design with three replications and seven different treatments. The foliar application of treatments T_1- Control, T_2 - Maleic hydrazide @ 5000 ppm, T_3– Maleic hydrazide @ 10,000 ppm, T_4 -Maleic hydrazide @ 15,000 ppm, T_5 - Chlormequat chloride @ 250 ppm, T_6 - Chlormequat chloride @ 500 ppm and T_7 - Chlormequat chloride @ 750 ppm was done at the time of flowering. In each treatment, five randomly selected plants from each replication in the net plot area were tagged and utilised to observe several rice growth

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characteristics and yield features. The data collected on various rice factors was statistically evaluated using the variance as recommended by Panse and Sukhtame (1985) and where the treatment difference was found to be significant, crucial differences were calculated at a 5 per cent probability level and compared to the treatment mean.

RESULTS AND DISCUSSION

Plant height in rice increased until 90 days after transplanting, and later it remained nearly constant. There was a significant difference between the treatments. Plant height was lower in the treatment Chlormequat chloride @ 500 ppm (T_6), followed by Maleic hydrazide @ 5000 ppm (T_2) with 61 cm and 62 cm respectively and the remaining treatments showed no significant difference (Table 1). The highest height (74 cm) was shown in the control (T_1) plot. Similar outcomes have been reported by Sooganna *et al.* (2012) and Hashem *et al.* (2016).The use of growth regulators causes the plant's height to be reduced, by creating deficiency in gibberellin production and thus decreasing the cell size and cell elongation. (Okuno *et al.,* 2014) reported that lowered plant height shifts the center of gravity to the lower side thus providing lodging resistance.

Regarding the number of nodes on the main culm, there was no significant change in the number of nodes between the treatments (Table 1). The results were in conformity with Gupta (1970) in rice. This could be attributed to a decrease in the main Culm's internodal length.

In the case of number of tillers per plant, the treatments (T_6) Chlormequat chloride @ 500 ppm and (T_2) Maleic hydrazide @ 5000 ppm recorded significantly more number of tillers (12.00) followed by (T_7) Chlormequat chloride @ 750 ppm (11.00). However, a lesser number of tillers were recorded in the treatments (T_3) Maleic hydrazide @ 10,000 ppm, (T_4) Maleic hydrazide @ 15,000 ppm and (T_1) control and were in parity by having 9.00 tillers per plant (Table 1).The plant may have produced more tillers as a result of higher photosynthetic activity and efficiency, which led to dry matter production. This finding was in agreement with Chaudhari *et al.* (1980) with the application of cycocel @ 100 and 200 ppm in rice and Prajapati *et al.* (2020) with the application of Chlormequat chloride @ 2000 ppm.

Throughout the growth period, the Crop growth rate (CGR) gradually increased. The Table 1 demonstrated that foliar application of plant growth regulator chemicals had a considerable impact on CGR. The control (T_1) had the lowest crop growth rate (8.06 g m^{-2} day^{-1}), which was comparable to Maleic hydrazide @ 10,000 ppm (T_3), Maleic hydrazide @ 15,000 ppm (T_4), and Chlormequat chloride @ 750 ppm (T_7) by recording 9.29 g m^{-2} day^{-1}, 8.88 g m^{-2} day^{-1}, 8.36 g m^{-2} day^{-1} respectively. The treatment Chlormequat chloride treatment @ 500 ppm (T_6) had the highest crop growth rate (11.48 g m^{-2} day^{-1}), which was on par with (T_2) Maleic hydrazide @ 5000 ppm (11.01 g m^{-2} day^{-1}). Similar results were observed by Chaudhari *et al.* (1980), Prajapati *et al.* (2020). CGR is attributable to the rapid development of both the sources and sinks, with increased biomass assimilation.

There was a considerable difference regarding the number of panicles per plant between the treatments.The treated plots recorded higher panicle number compared to control.The treatment (T_6) Chlormequat chloride @ 500 recorded highest number of panicles per plant (10.00) followed by (T_2) Maleic hydrazide @ 5000 ppm (9.33), whereas a lesser number was recorded in (T_1) control (6.66) (Table 1). More fertile tillers result from active assimilation and translocation of food reserves from source to sink, resulting in the formation of more panicles per plant. Our findings are similar to those of Hashem *et al* (2016).

The highest harvest index was obtained with treatment (T_2) Maleic hydrazide @ 5000 ppm (43.75 %), which was on par with (T_6) Chlormequat chloride @ 500 ppm (42.00 %) and (T_7) Chlormequat chloride @ 750 ppm (41.52%). Following that, the remaining treatments (T_4) Maleic hydrazide @ 15,000 ppm, (T_5) Chlormequat chloride @ 250 ppm, (T_3) maleic hydrazide @ 10,000 ppm and (T_1) control had values of 37.48%, 38.56%, 32.25%, 30.16% respectively (Table 1). Shraddha *et al.* (2019) in rice and Singh *et al.* (1988) in Indian mustard also revealed similar results. The enhanced metabolite mobilisation from source to reproductive sinks caused an increase in harvest index.

The results of this study confirmed that Chlormequat chloride @ 500 ppm (T_6) was effective in imparting lodging resistance to crop and partitioning of assimilates to grain by improving its morphological and yield parameters.

Table 1. Effect of Chlormequat chloride and Maleic hydrazide on morpho-physiological parameters of rice

S. No.	Treatments	Plant height (cm)	No. of nodes on main culm	Crop growth rate (g m^{-2} day^{-1})	No. of tillers $plant^{-1}$	No. of panicles $plant^{-1}$	Harvest index (%)
1	T_1: Control	74	8.02	8.06	9.00	6.66	34.66
2	T_2: Maleic hydrazide @ 5000ppm	62	6.48	11.01	12.00	9.33	43.75
3	T_3: Maleic hydrazide @ 10,000ppm	67	7.67	9.29	9.00	7.33	32.25
4	T_4: Maleic hydrazide @ 15,000ppm	67	7.67	8.88	9.00	7.66	37.48
5	T_5: Chlormequat chloride @ 250ppm	67	7.03	9.62	10.00	8.00	38.56
6	T_6: Chlormequat chloride @ 500ppm	61	6.83	11.48	12.00	10.00	42.00
7	T_7: Chlormequat chloride @ 750ppm	67	7.55	8.36	11.00	8.66	41.52
	Mean	66	7.22	9.52	10.28	8.23	38.60
	CD (p=0.05)	6.96	NS	1.35	1.83	0.96	3.34
	SE(m)±	2.32	0.41	0.44	0.60	0.32	1.11

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