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Role of Plant Growth Promoters and Regulators on Rice and Maize

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Abstract

Role of plant growth regulators is one of the current scientific areas of research and it more or less depends on the area of implementation. Now in recent times, application of plant growth regulators or PGR is applying in the field for getting a high range of yield. This study discusses a wide range of plant growth regulators and their application in two major crop plants- Rice and maize. Result of various enzymatic activities and also influence of various other promoters has been discussed efficiently to get a fundamental idea about the role of different PGR and PGP (Plant Growth Promoter). Activity of various types of bacterial species has also been included in this study to get a precise knowledge about plant growth regulators and their roles in yield. Different morphologically distinct variables of rice and maize have been taken for the study and their morphological changes have been addressed. The results which have been obtained from two distinct genus also give different results. In case of rice, treatment was arranged in a split plot design with the aid of four replications and in case of maize changes of activity of RE 1 and RE17 expression has been effectively calculated.

Keywords

Enzymatic activities, morphological changes, PGP, RE1, RE17, Rice and maize.

INTRODUCTION

Application of plant growth regulators is immense and rising exponentially in recent times. ***PGR and PGP*** have distinct roles in rice and maize but their mode of action is different depending on their time of action. In general, the plant growth regulators are hormones which are important in different fields of plant growth. Out of the hormones, ***Auxin*** is known as one of the best plant growth promoters especially in case of ***rice and maize.*** Conversely, Auxin also works as plant growth promoter and regulator in the different growth stages of crop development. As mentioned by [1] (2020), ***PGR*** affects the ***seed filling process*** in maize to a large array. In general, the seed filling process is the developmental stage of maize which is divided into two stages- ***Pollination and initiation of the seed development.*** In case of maize, the genome analysis shows that, total ***90 non redundant*** loci have been identified by using ***bulk segregant RNA sequencing.*** Eight genes have been discovered in this scenario which has been influenced by different plant growth regulators. GRMZM2G391936 and GRMZM2G008263 are two genes that are required for analysis of ***starch and sucrose metabolism*** with the aid of biosynthesis of other secondary metabolites ([7]. 2021).

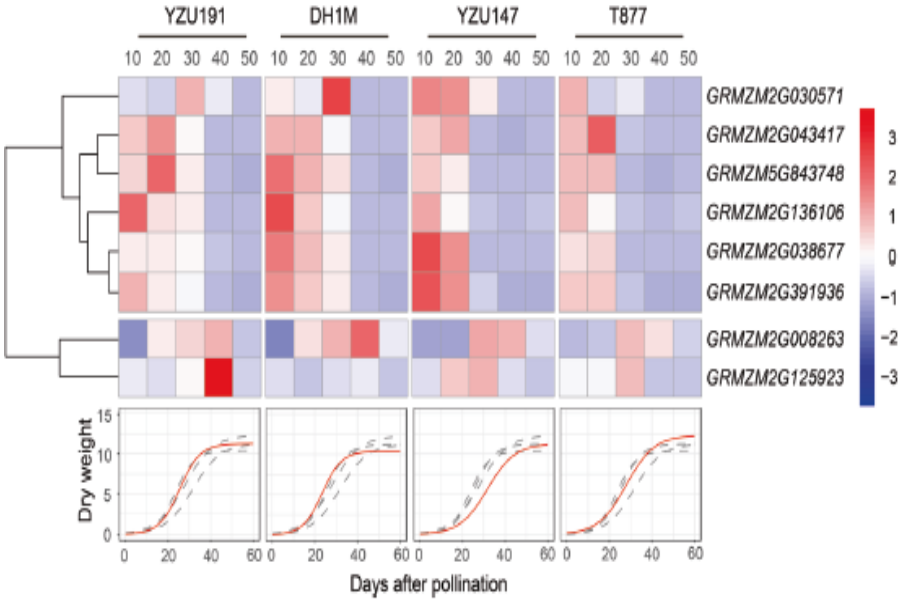

Figure 1: Estimated expression level of eight genes of *maize*
(Source: [7]. 2021)

Conversely, in the case of rice it has been seen that exogenously applied ***PGR and PGP*** have a wide range of roles for enhancing their overall growth and metabolism. High temperature is needed for checking the liquid formulation of these ***PGR.*** Two rice cultivars ***Peizataifeng and Huayou86*** have been taken in this experiment to proceed with the best result. Four ***PGR combinations*** have been analyzed in this scenario to get a valuable result regarding rice growth. The names of four hormones are- "***alpha-tocopherol (Ve)" , "Ascorbic acid (Vc)", "Brassinosteroids (Br), Methyl jasmonates (MeJA).*** The most effective ***PGR condition*** in this scenario is Vc+Ve+Br+MejA which shows the highest range of grain production.

SEED FILLING PROCESS IN MAIZE

The application of ***Uniconazole and its combination with ethephon*** enhance the rate of seed filling in ***Maize.*** Endogenous hormone content regulation is the main theme in this scenario. As per the ideas of [3]. (2019), ***uniconazole*** can be singly applied or can be applied by combination with ethephon which is able to increase grain yield. ***Uniconazole*** is applied in the ***foliage leaves*** of ***Maize*** at the end of 10 ***day*** after the stage of silking. Subsequent concentrations for the ***seed filling*** are- ***25 mg/*** **L uniconazole + 100 mg L-1** ***ettephon*** **(U 25+ E 100), 50 mg L-1 ethephon (U75+E300).** In contrast to the ***uniconazole,*** the rate of ***Abscisic acid (ABA) and Zeatin (Z)*** can be effectively increased after a point of treatment.

RICE HYBRIDS AND PGR

In contrast to the rice hybrid yields, it can be said that the advantages of 20% has effectively developed in the 1970s and now the production of this hybrid has increased by about 57%. In order to understand the behavioral process of rice, analysis of the plant growth regulator needs to be understood effectively. The use of ***GA3, PBZ and 6- BA*** has been understood to ensure efficient production. Various types of plant growth regulators, namely- ***GA3*** is the vital hormone that plays a significant role in rice growth. According to the view of [5]. (2019), the production of high yield of crop is more or less dependent on mRNA sequestration. ***GA3*** is addressed for stimulation of production of ***mRNA molecules*** in the cells. Different ranges of growth conditions are included in this study that shows mRNA molecules are required for the fast growth. Increase of the cargo molecules content is the main theme of this study of rice hybrids and it is dependent on the systematic development of ***mRNA molecules.*** Crude protein and ***nonstructural carbohydrate or NSC*** has been increased by spraying ***GA3*** after the process of anthesis. Primary ***GA3*** plays an effective role for decreasing the salinity and increasing the number of grains. The role of primary ***GA 3*** plays an important role for ***pattern accumulation.*** In general, ***pattern accumulation*** is the main theme which is crucial for recognition of gene activities [6]. (2017). The gene activity is the process of measuring the role of different plant growth regulators in this scenario. There are two new super hybrid rice ***Peizataifeng and Huayou86*** are used as two line hybrid rice. A total day about ***125 to 115 days*** is required in this scenario for measuring the acute developmental pattern. In order to discuss the feature of ***Huayou86*** it can be said that it is one of the newest combinations of ***temperate three late maturity lines*** of hybrid rice.

In this article, discussion regarding antioxidant enzyme quality and also grain quality has been observed in the super hybrid rice. In case of ***Maize,*** chilling tolerance has been discussed and conversely, in case of rice, high temperature growth has been discussed. In addition, biochemical and physicochemical analysis has been discussed here which is beneficial for understanding the role of ***PGR*** in different aspects of ***rice and maize.***

MATERIAL AND METHOD

Plant husbandry and growth condition

Study of plant growth regulators can be carried out in the greenhouse temperature. The two rice hybrids have been effectively studied under this condition. In general, rice plants are used to develop at the normal environment till the ***stage of blotting.*** The facility of the germination can be checked at the level of gene expression. Levels of antioxidant enzymes can proceed with the titration method. In general, the ***titration method*** is the first and the foremost crucial process for analyzing the concentration of the enzyme [4]. (2021). The level of antioxidant enzyme which is produced in rice and maize is dependent on the level of gene expression. ***Peizataifeng*** has a high level of temperature tolerance which can be enhanced by the application of ***cytokinin*** in this scenario.

In the case of the rice, ***3 weeks*** have been transplanted, which more or less depends on the heading date of all varieties.

In case of maize the generic and the genome analysis of the seed feeling process in maize is determined. A ***recombinant inbred line (RIL)*** has been used in this study from other different inbred lines. The parent line is ***DH1M and T877*** that have different ranges of seed filling dynamics. In contrast to ***Maize,*** the recombinant lines have been effectively studied by which ***208 lines*** have been generated. The duration of the grain filling is significantly different regarding ***DH1M and T877.*** In order to discuss the shorter green filling, ***DH1M*** has been subjected to a different green filling. On the other hand, ***T877*** has a significantly longer period of grain filling. In each time point, ***synchronous*** development of seed has been addressed. Significant changes of hot and cold have been addressed in this scenario which is beneficial for understanding the role of ***PGR.***

In the case of rice, different combinations of ***PGR*** have been applied for understanding the condition of the development. The PGR treatments are used to analyze the growth of the plants includes:-

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1. **Vitamin E + Vitamin C+ brassinosteroids + methyl jasmonate**
2. **Triazoles + Methyl jasmonate + brassinosteroids.**
3. **Vitamin C+ Vitamin E**
4. **Methyl jasmonates (MeJA)**
5. **Control**

Vitamin C and E with the aid of other hormones has been applied at a rate of ***1.4, 6.9, 1.8, 4.0 and 0.55 ppm solution.*** In the case of the rice cultivars, statistical analysis has been performed to understand the role of the ***PGR*** in this scenario. On the other hand, in the case of maize, calculation of the descriptive statistics has been performed in this scenario with the aid of ***H2 testing. H2*** is a ***Broad-sense heritability*** across multiple environments that can be estimated as***" H2 ¼ δ2g = δδ2gþ δ2=eÞ".***

FINDINGS

The effect of different plant growth regulators has been studied in this scenario which shows that all of the ***PGR*** has wide roles for developing different parts of plants. As ***Maize and Rice*** are crop plants then correlation among all of the parameters need to be analyzed. In both cases, different results have been observed.

In case of ***maize,*** dry weight of seeds, duration of filling and rate of filling is the main theme to discuss. Significant variants have been found in this scenario which depends on accumulation of the dry weight. The variants are ***environment, genotypes and genotype by the reaction of environment.*** In case of ***RIL lines*** it has been found that coefficient variations are ranging to ***9.53 to 45.11%.*** It can also be interpreted that there is significant genetic variation of seed filling dynamics in the population of segregation. Positive relationship between all of the variables has been found which shows that TFD or total filling duration and final seed weight is correlated. Genetic map has been constructed in this scenario that is intermingled with the ***QTL mapping*** analysis. In order to discuss the role of ***QTL*** it can be said that QTL is the abbreviation of ***Quantitative trade loci*** which is a part of **DNA** and responsible for special phenotypic traits. Polygenic effect is also possible in the part of ***QTL.***

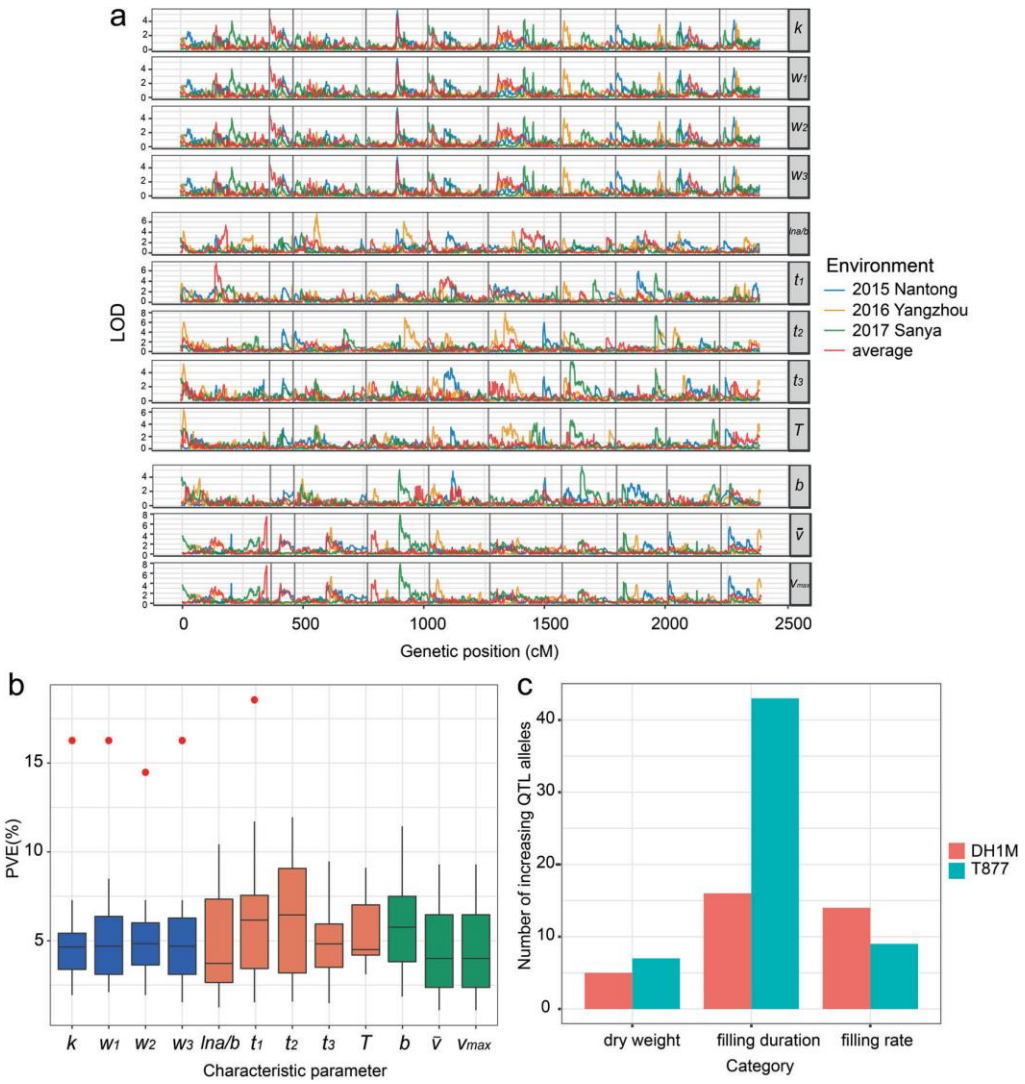

Figure 2: QTL analysis of *maize*
(Souce: [8]. 2020)

In contrast to rice, thermoregulation and leaf physiology is the main theme that needs to be understood after the application of ***PGR*** like ***brassinosteroid, methyl jasmonate and triazole.*** The findings show that leaf physiology of rice was affected negatively under the condition of high night and day. High stress of temperature is the main theme which affects a large array for both types of rice cultivars. It has also been observed that the photosynthesis of rice has hampered through limiting the uptake of ***stomatal CO2.*** Significantly the application of different ***PGP or the plant growth promoters*** have reduced the stress to a range of ***17.11% and 14.02%*** in both varieties. Both of the cultivars have a variation in their behaviour that completely depends on combination of all of the hormones.

CONCLUSION

The above study shows that plant growth promoters and plant growth regulators are likely to be equal but their functions have altered. Alternation of the function has been observed in different conditions of the development. Rice temperature analysis has been used to understand the role of ***PGR or PGP*** in their physiological process. On the other hand, in the case of maize, application of the seed filling process has been effectively discussed for perceiving the role of ***PGP.*** The above study shows that reduction of stress is the main job of ***PGR and PGP.*** Two different physiological conditions have been undertaken in this scenario for understanding the role of ***PGR.*** Logistic function based approach has been discussed in this study that consists of various stages of seed development under the condition of stress. Conversely, in the case of rice, an increase of spikelet has been measured for understanding the temperature tolerance. It can be interpreted that development of the height has effectively been observed after the application of ***PGR***.

REFERENCE

[1] Liebsch, D. and Palatnik, J.F., 2020. MicroRNA miR396, GRF transcription factors and GIF co-regulators: a conserved plant growth regulatory module with potential for breeding and biotechnology. Current opinion in plant biology, 53, pp.31-42.

[2] Ahmad, I., Kamran, M., Meng, X., Ali, S., Bilegjargal, B., Cai, T., Liu, T. and Han, Q., 2019. Effects of plant growth regulators on seed filling, endogenous hormone contents and maize production in semiarid regions. Journal of Plant Growth Regulation, 38(4), pp.1467-1480.

[3] Anwari, G., Feng, J. and Moussa, A.A., 2019. Multiple Beneficial Effects of Using Biochar (as a Great Organic Material) on Tolerance and Productivity of Rice under Abiotic Stress. Journal of Modern Materials, 6(1), pp.40-51.

[4] Orlien, V., Aalaei, K., Poojary, M.M., Nielsen, D.S., Ahrné, L. and Carrascal, J.R., 2021. Effect of processing on in vitro digestibility (IVPD) of food proteins. Critical Reviews in Food Science and Nutrition, pp.1-50.

[5] Fukao, T., Barrera-Figueroa, B.E., Juntawong, P. and Peña-Castro, J.M., 2019. Submergence and waterlogging stress in plants: a review highlighting research opportunities and understudied aspects. Frontiers in Plant Science, 10, p.340.

[6] Han, Y., Huang, K., Liu, Y., Jiao, T., Ma, G., Qian, Y., Wang, P., Dai, X., Gao, L. and Xia, T., 2017. Functional analysis of two flavanone-3-hydroxylase genes from Camellia sinensis: a critical role in flavonoid accumulation. Genes, 8(11), p.300.

[7] Dwivedi, S.L., Spillane, C., Lopez, F., Ayele, B.T. and Ortiz, R., 2021. First the seed: Genomic advances in seed science for improved crop productivity and food security. Crop Science, 61(3), pp.1501-1526.

[8] Yin, S., Li, P., Xu, Y., Liu, J., Yang, T., Wei, J., Xu, S., Yu, J., Fang, H., Xue, L. and Hao, D., 2020. Genetic and genomic analysis of the seed-filling process in maize based on a logistic model. Heredity, 124(1), pp.122-134.

[9] Khan, N., Bano, A. and Zandi, P., 2018. Effects of exogenously applied plant growth regulators in combination with PGPR on the physiology and root growth of chickpea (Cicer arietinum) and their role in drought tolerance. Journal of Plant Interactions, 13(1), pp.239-247