Industry and Academic Research Review
Volume 4 Issue 1 July 2023

Growth and Yield Response of Pepper to Foliar Application of Carrageenan Plant Growth Promoter

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Abstract

The study determined the growth and yield response of pepper (Capsicum annuum L.) to varying concentrations and frequencies of Carrageenan Plant Growth Promoter (CPGP). The study was set-up in a split-plot randomized complete block design with three replications. The three varying application frequencies were designated as main-plots, and the four concentrations of CPGP, as sub-plots. Peppers applied with 120 ppm and two to three times application of CPGP significantly matured earlier based on number of days to flowering and number of days to first priming. The same treatment combination resulted in significantly taller plants and higher number of lateral shoots. In terms of yield, however, CPGP at 120 ppm applied three times gave significantly higher number and heavier weight of fruits. The concentration of 120 ppm CPGP applied thrice in growing pepper is shown in the study to be the best treatment combination, thus, is recommended to improve the growth and increase the yield of pepper.

Keywords: *carrageenan, CPGP, concentration, frequency*

Article History:
***Received**: May 25, 2023*
***Revised**: June 4, 2023*
***Accepted**: June 20, 2023*
***Published online**: July 31, 2023*

Suggested Citation:
Guzman, X.F. & Valdez, M.T. (2023). Growth and Yield Response of Pepper to Foliar Application of Carrageenan Plant Growth Promoter. *Industry and Academic Research Review*, 4 (1), 426-430.

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**This paper is presented at the 4th International Conference on Multidisciplinary Industry and Academic Research (ICMIAR)-2023*

Introduction

With the increasing demand for pepper worldwide, the market is expecting a continuous upward market trend up until 2025. It is projected that at the end of 2025, pepper market volume will be 840,000 T. However, there are indicated fluctuations of pepper production from 2007-2018 (Globe Newswire, 2020). In the Philippines, pepper production is about 15 T/ha as of 2017 (DA-RFO2, 2017). Depolymerized carrageenan through gamma-irradiation is a polysaccharide and a stimulant that has been a subject for researches in the recent years (Naeem, *et al*., 2014; Abad *et al*., 2011, 2016, 2017). This is commercially known as carrageenan plant growth promoter (CPGP). This plant stimulant aims to increase the growth and yield of pepper to aid in the projected increase in pepper demand. There has not also been much studies concerning the effects of CPGP on pepper. According to Abad (2018), there have not been studies to credit the effect of carrageenan on vegetables. Factors like dosage and frequency, among others should be considered (MMSU, 2018). Thus, this study determined the effect of CPGP on Solanaceous crops and recommend the optimum concentration and frequency of application for farmer's utilization.

Methodology

***Foliar Application of Treatments*.** Application of different treatments started from ten days after transplanting. It was done every ten days (Ali, 2014), in accordance to the designated frequency of application. A hand-held pressurized sprayer was used to apply the different concentrations of CPGP, with the aid of plastic sheets to prevent unwanted spread of applied treatments to other plots. The amount of solution sprayed increased as the plants grow. Treatments were applied early in the morning.

In a personal communication with Dr. Lucille V. Abad, inventor of the Carrageenan Plant Growth Promoter (CPGP), the base concentration is 10,000 ppm. Dilution for treatment application of the CPGP were 60 ppm, 120 ppm, 240 ppm, and 480 ppm with application frequencies of 2x, 3x, and 4x.

Determination of Growth Attributes

Number of days to flowering. The number of days to flowering was counted from transplanting to the day when 50 percent of all the plants in each replication have at least three opened flowers.

Number of days to first priming. This was counted from transplanting to the day when 50 percent of all the plants in each replication have at least one fruit ready for harvest.

Plant height. Plant height was measured from the surface of the soil to tipmost part of the main stem. It was done at 60 DAT.

Number of lateral shoots. Lateral shoots were counted at 60 DAT.

Determination of Yield Attributes

Number, weight, and percent non-marketable fruits per plot. The number and weight of non-marketable fruits per plot were counted. The different indices used to identify damaged or non-marketable fruits were presence of holes, occurrence of alteration in coloration of fruits, the inside of the fruit is hollow and filled with frass, curled fruits, and rotten fruits.

Number, weight, and percent marketable fruits per plot. Fruits without the presence of holes, frass, rot, curling or any damage, per plot, were considered non-infested or marketable fruits, and were counted and weighed.

Total number and weight of fruits per plot and per plant. This is the cumulative (six harvestings) number and weight of infested plus non-infested fruits per treatment.

Computed yield per hectare. The total weight of marketable fruits harvested in a yield plot area (4 m^2) was converted into per hectare basis.

Findings

Plants that received foliar application three times had significantly shorter time to flower opening. Furthermore, treatments with 120 ppm concentration of Carrageenan Plant Growth Promoter (CPGP) had the earliest time to flowering at 30.88 days after transplanting (DAT), nine days earlier than both controls.

Earliest priming was done in plots treated three times with CPGP, as well those that were applied with 120 ppm concentration, where fruits were primed 10 days earlier than both control treatments. Moreover, results of plant height revealed that there is no significant effect between application frequencies. Concentration of 120 ppm, on the other hand, presented the tallest plant at 69.74 cm at 60 DAT. Tallest peppers came from plots treated thrice at 120 ppm and 240 ppm.

Pepper plants that received three times application had the most number of lateral shoots. Frequency of three times at 120 ppm and 240 ppm concentration had the greatest number of branches at 13.67. Furthermore, application frequency of three times produced the highest number of fruits at 1572.39. Moreover, 120 ppm produced 49 more fruits than 240 ppm concentration, which had the next most number of fruits. However, there is no significant difference between 120 ppm and 240 ppm concentration and twice and thrice application frequency.

The weight of marketable fruits was heaviest at the interaction of three times application frequency and 120 ppm at 8614.63 g, and treatments with three times of application gained the highest total weight of fruits at 6739.56 g, four times frequency gained 6453.92 g, and application of CPGP two times had 6016.85 g of fruits. Moreover, treatments applied with 120 ppm gained 3918.98 g more than the negative control, and 2839.13 g more than the positive control.

Aphid population was not affected by the application of CPGP at any frequency of application or concentration. On the other hand, plants treated with concentrations of 120 ppm and 240 ppm CPGP, irrespective of the frequency of application, are more resistant to fusarium wilt compared to both positive and negative controls, which had the highest rate of infestation. Carrageenan Plant Growth Promoter concentrations of 60 ppm and 480 ppm had influenced approximately the same number of plants that were infected with the fusarium wilt but are lower than those of the control treatments.

Conclusion

Interaction of three-time frequency of application and 120 ppm concentration of Carrageenan Plant Growth Promoter (CPGP) shortened the number of days to flowering and first priming. It also gave the highest plant height, number of branches, number and weight of marketable and non-marketable fruits, total weight of fruits per plot and computed yield per hectare.

Concentration of 120 ppm CPGP foliar spray gave the best results in all growth and yield parameters tested in the study. Among the three frequencies tested, foliar application of CPGP three times in pepper yielded best results. Foliar application of CPGP at 120 ppm and 240 ppm reduced the rate of fusarium wilt infection in pepper plants.

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