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EFFICACY OF TIMING AND NUMBER OF POLLINATING OVERLAPPING WITH SUPER DOCSON ON CUCUMBER SEED PRODUCTION OF F1 HYBRID SEEDS FOR GREENHOUSE

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ABSTRACT

This study was carried out in non-warmed greenhouse during the spring season 2020. Two local cucumber races were cross pollinated. One of the cucumber race was modified as male flowers that used to pollinate the cross pollination. Four pollination timing performed with three replication for each, 1st pollination at 6:00 am, 2nd at 16:00 pm, 3rd at 6:00 am and 16:00 pm, 4th at 16:00 pm and 6:00 am, along with Super Docson treatment 0, 1.5 and 2.5 ml/L. Matured cucumber fruits were collected, and then the seeds were extracted. The statistical analysis of the results shows that both the pollination time and the Super Docson significantly affected the plant growth properties. The pollination at 6:00 am and 16:00 pm has significantly increase the plumule and root along with stem diameter for seedlings at 6.522 cm, 7.001 cm and 2.420 mm respectively. Super Docson treatment show improving in vegetation growth properties at the concentration of 2.5 ml/L to be 6.0623 cm, 7.044 cm and 2.503 mm respectively. In addition, the average weight and seed number of the 100 seeds extracted from the fruits pollinated at 6:00 am and 16:00 pm and treated with Super Docson 2.5 ml/L were found to be 132.556 and 121.0 seed/fruit and 3.332 and 3.395 g/100seed respectively.

Keywords: *Cucumis sativus*; crosses; pollination; hybrid.

INTRODUCTION

Cucumber is related to the family of cucurbitaceous, and it is one of the commonly consumed vegetables around the world [1]. India is the origin of the cucumber, where different types were found including *Cucumis hystrix*. Then, it moved to Europe by Romans and Greeks [2]. Recently, hybrid cucumber seed in demand in market due to highly quality and production [3]. To produce F1 hybrid seed, two main processes should be successfully performed; pollination and fertilization. The pollination means transfer the pollen to the stigma. The flowers contain of the nectar and the pollen that attract the flying insects [4].

To have highly and efficiency pollination and fertilization, some pollination factors should be considered. These factors include the numbers of pollen that fall on the stigma throughout visits of the flying insects the average and number of the visits the flower receives [5]. Using of the foliar spray with the micronutrients for the plants that suffer shortage in Zn, B and Fe show enhances the fertility and increases the pollination process [6]. Increase the demand for the high quality seeds encourages the consumers to compete with each other [7]. This study aimed to determine the best time for pollination to mass production of hybrid seeds, and use the super Dixon to promote the ovaries and increase the fertility and enhance seed production.

MATERIALS AND METHODS

The river soil has been laid in a greenhouse of a total area of 350 m^2. Greenhouse was divided to five stages and each with 35 m long, 0.6 m width and 0.5 m above the soil level. The distance between the stages was 0.9 m. The greenhouse was then covered with polyethylene thickness of 200 micrometer. A dripping water system was installed inside the greenhouse. Several samples of the soil were randomly collected from different areas within the greenhouse, and mixed together and analyzed to determine its characteristics.

Two pure and genetically divergent local breed seed C-1035 and C-1036 were used in this study. The flowers for the C-1036 were modified from female to male because these lines are specified for greenhouse production. Also, these lines are gynoecious type only genoecious flowers. Therefore, once the first leaf show seedling sprays with sexual modification materials that enhancing the male flowers. Then, the self-pollination and the plants crosses completed and the hybrids produce to be compared with their parents.

The male line planted on 01/02/2020 while the female line planted on 12/02/2020, crop served by follow the recommended space, fertilization, climbing process and pest control during the planting season.

Super Docson (Fe 0.40%, B 0.45, Ca 0.35, Mn 0.40%, Cu 0.12%, and Mo 0.05%) sprayed on the treatments plant at 35, 42, 59, and 56 days after planting with three concentrations 0, 1.5, and 2.5 ml/L.

The modified male line started to flower on 15/03/2020 few days before the female line. A day before the crosses process, the male and female flowers were covered with paper bags to prevent the cross pollination. Then, the male flowers were used to pollinate the female flowers. The flowers were covered again after crossing to prevent the insects for cross pollination. Each pollinated flower was labeled, and the pollination date was recorded to determine the period time between the pollination and the fruit maturity. Two days later, all bags that covered the pollinate flowers and the non-pollinate flowers were removed. Only five pollinated flowers left in each plant to manage the growth of plant and fruit to maturity. The fruits turn to yellowish color after their full maturity within a period of 50 – 55 days from the pollination to the harvest. The fruits were harvested with respect to the pollination time, and the seeds were extracted by the fermentation process. The experiment was design used Randomized Complete Block Design (RCBD). Genstat software was used to analyze. The comparison between the mean values of the characteristics and the control was made using the Least Significant Difference (L.S.D) on a moral level of 5%. The measured characteristics:

Vegetative Growth

Length of seedling plumule

Ten seedlings were selected at the end of the germination duration of the six day, the radicle was separated from the plumule [8].

Length of the seedlings radical

Ten seedlings were randomly selected at the end of the germination duration after removing and washing them, and the radicle was separated from the plumule [8]. A ruler was used to measure the length of the radicle.

Stem diameter of the seedlings

Measure was taken randomly by measuring the diameters of ten seedlings from each experiment using a caliper ruler.

Table 1. The properties of the soil analysis in this study

Soil compounds	Unite
Electrical conductivity EC	2.8 dS/m^{-1}
Soil pH	7.2 neutral
Gypsum	Zero
Lime	11 g/kg^{-1}
Sand	84.3 g/kg^{-1}
Mud	8.5 g/kg^{-1}
Silt	7.2 g/kg^{-1}
Soil texture	Mix
Organic matter	0.3 g/kg^{-1}
Nitrogen	0.75 mg/kg^{-1}

Characteristics of the Seeds

Total number of the seeds/fruit

This was calculated by randomly selecting of 10 fruits from each experiment, and the seeds were extracted and seeds calculated using the following relation:

> No. of the seeds in a fruit = No. of the seeds per an experiment / No. of fruits per an experiment

Average weight of 100 seeds (gram)

Five samples from 100 seeds of each experiment for the three repetitions were selected and weighed using a electronic scale, then the average was calculated [8].

RESULTS AND DISCUSSION

Vegetative Growth

The results show that the pollination time has influenced the quality of the seeds, and the best results were obtained for the pollination time at 6:00 am and 16:00 pm. This contributed to produce high quality seeds which induce the properties of seedlings vegetative growth represented by plumule length, radicle length and stem diameter. The obtained results are showed in (Tables 2, 3 and 4).

This could be explained based on the time stigmas of the female flowers are ready to receive the pollen and germination of the pollen tube. Repeat the pollination process on same flower may results in enhancing the fertility of the ovules and hence more high quality seeds will be produced. These results agree with the results obtained by [9] and [10] through their studies on cucumber. It has been reported that there is a relationship between the vegetative growth and the size of the seeds that affect the plumule length, radicle length and stem diameter of the seedlings. This is because the seeds with high nutrient content enhance the characteristics of the vegetative growth compared to weak seeds, and this result also agrees with [11].

Regarding the use of Super Docson, the concentration of 2.5 ml/L shows the best characteristics of plumle length, radicle length and stem diameter for the seedlings Fig. 1. Because of the role of some micronutrients in most physiological and biological activities that happen in the plant. The treatment with boron may results in improving the growth of the plant by increasing the IAA content, enhancing some biological activities of the Auxin hormone that enhances the division and elongation of the cells and subsequently increases its level in the plant, enhancing the pollination and fertility processes that increasing the ratio of the fertilization and fertility of the ovules, increasing the levels of the carbohydrate and the proteins along with transmission of the sugar from the producing section to different growth and storage areas, and finally enhancing the quality of the seeds. These results are agrees with the results reported by [12,13,14].

The addition of a mix of zinc and boron results in producing the carbohydrates, differentiation and division of the cells, contributing with metabolism system inside the plant and facilitating the photosynthesis productions from the leaf to other active parts of the plant that resulting in significant differences in the vegetative growth and the yield increase the seeds number and quality. These results are agrees with those for [15,16]. Treat plants with iron also contributes in the formation of the chlorophyll that promoting the photosynthesis productions and therefore enhances the vegetation growth characteristics such as plumule length, radicle length and stem diameter of the seedlings [17].

Table 2. Displays the effect of pollination time and the super docson on the plumule length

Super docson / Time of pollination	0.0 ml/L S0	1.5 ml/L S1	2.5 ml/L S2	Treatment mean
T_1	5.537	5.853	6.163	5.851
T_2	5.247	5.603	5.810	5.553
T_3	5.653	6.450	7.463	6.522
T_4	5.577	6.227	7.053	6.286
Mean	5.503	6.033	6.623	
LSD S			0.038 **	
LSD T			0.044 **	
LSD S*T			0.076 **	

Fig. 1. Cucumber Seedling treatment showing plumule length, radical length, and seedling growth from left to right. Right: Treated with Super Docson 2.5 ml/L. Left: The control (not treated)

Table 3. Displays the effect of pollination time and the super docson on the radicle length

Super docson / Time of pollination	0.0 ml/L S0	1.5 ml/L S1	2.5 ml/L S2	Treatment Mean
T_1	5.647	6.230	6.743	6.207
T_2	5.430	5.710	6.070	5.737
T_3	5.880	7.103	8.020	7.001
T_4	5.770	6.827	7.343	6.647
Mean	5.682	6.468	7.044	
LSD S			0.051 **	
LSD T			0.059 **	
LSD S*T			0.103 **	

Seeds Characterizations

(Tables 5 and 6) show that the pollination time has a significant effect of the studied seeds characteristics on the average number of the seeds in the fruit and the weight of a 100 seed.

This may related to the differences of the pollination time at the blossoms bloom, the circumstances of the blossom to receive the pollen and the long period of being active. Therefore, both the pollination time and pollens number are very important factors in controlling the yield and the characteristics of the seeds. This is because the flower stigmas are bloomed for longer time, and ready to be pollinated. Also, increasing the number of pollination on the same flower promotes the formation of more pollens that significantly affecting the fertilization of the ovules and therefore high yield of the seeds was achieved. These results are consistent with the results reported by [9,14]. They show that increasing the number of visiting the flowers by bees has resulted in a significant increasing in the seeds characteristics, number of the seeds and the weight of a 100 seed.

Table 4. Displays the effect of pollination time and the super docson on the stems diameter

Super docson / Time of pollination	0.0 ml/L S0	1.5 ml/L S1	2.5 ml/L S2	Treatment mean
T_1	1.700	2.100	2.267	2.022
T_2	1.567	1.933	2.133	1.878
T_3	1.833	2.460	2.967	2.420
T_4	1.767	2.253	2.643	2.221
Mean	1.717	2.187	2.503	
LSD S		0.054 **		
LSD T		0.062 **		
LSD S*T		0.108 **		

Table 5. The effect of the pollination time and the super docson on the average seed number of the fruit (seed/fruit)

Super docson / Time of pollination	0.0 ml/L S0	1.5 ml/L S1	2.5 ml/L S2	Treatment mean
T_1	105.333	114.667	119.667	113.222
T_2	88.000	93.667	97.000	92.889
T_3	126.333	130.000	141.333	132.556
T_4	117.000	123.667	126.000	122.222
Mean	109.167	115.500	121.000	
LSD S		1.556 **		
LSD T		1.796 **		
LSD S*T		3.111 **		

Table 6. The effect of the pollination time and the super docson on the average weight of a 100 seed (gram)

Super docson / Time of pollination	0.0 ml/L S0	1.5 ml/L S1	2.5 ml/L S2	Treatment mean
T_1	3.133	3.363	3.383	3.293
T_2	3.097	3.343	3.377	3.272
T_3	3.180	3.387	3.430	3.332
T_4	3.170	3.380	3.390	3.313
Mean	3.145	3.368	3.395	
LSD S		0.012 **		
LSD T		0.014 **		
LSD S*T		0.024 *		

Regarding the use of Super Docson, the results show a significant increase in the average seed number of fruit and the average weight of 100 seed. This is related to the role of some micronutrients in most physiological and biological activities that happen inside the plant. The treatment with boron plays a major role in the division of the cells and the formation of the cell's wall, and enhancing the photosynthesis, and production of pollens, and enhancing the pollination and fertilization processes that increasing the ratio of the fertility, pollen germination, pollen tube and the fertilization of the ovules, increasing the levels of the carbohydrate and the proteins along with transition of the sugar from the producing areas to different growth and storage areas, and finally increasing the yield of the seeds and their sizes. All these results are agrees with the results reported by [12,13,14].

The addition of the zinc enhances the production of the carbonic anhydrase enzyme which helps the carbon dioxide in the photosynthesis process. Also, the boron plays an important role in the production of tryptophan amino acid that enhances the growth of the plant and the production of Auxin hormone. In addition, the boron stimulates

the ovaries and ova, therefore enhances the fertilization of the ovules, synthesize of enzymes and proteins and easily arrive to the seeds and hence high quality seeds achieved. These results are agrees with the [18]. The iron is very important factor in the redox reaction processes through the respiration and photosynthesis processes. Also, the iron contributes in the formation of the proteins and several enzymes and then increases the quality of the resulted seeds. These results are consistent with those for [17].

CONCLUSION

Based on the Achieved Results we may conclude:

1. Consider 6:00 am and 16:00 pm as the best time for pollination because the flower stigma is ready to receive the pollens and grow the pollen tube.
2. Consider the seeds resulted from the treatment with 2.5 ml/L Super Docson that helps in enlarging the ovaries and completed the pollination process. Also, consider the repetition of the pollination that improving the quality of the seeds and their nutrient concentrations.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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