Studying the Effects of Artificial Pollination and Cycocel Hormone on Germination Traits of Hamedani Alfalfa Seed

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Abstract: In order to investigate the effects of various concentrations of ccc and artificial pollination on the components and behavior of Alfalfa seeds, an experiment of splitting plots with completely randomized blocks and three replications was performed in two-purpose fields (seed-forage) of Boroujerd' s research agricultural station. Basic treatment includes artificial pollination through stretching the rope in two stages at 70% levels of pollination which was replicated in 100% pollination stage as compared to control treatment and the second treatment involves different concentrations of Cycocel Hormone (0, 1.6, 3.2, 6.4 liter/ha). The results obtained by analysis of variance indicated that the effects of artificial pollination on the bush length are significant at 5% level in the hormone treatment and considering the number of seeds at artificial pollination and hormone levels, they were significant at the levels of 5 and 1 percents, respectively. In this study, the minimum rate of length and maximum number of seeds were demonstrated by the levels of 6.4 liter and 70%+100%.

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Key words: Ccc (cycocel), artificial pollination, alfalfa seed.

1. Introduction

Alfalfa (Medicago sativa l.) is one of the most important forage plants playing a crucial role in providing the required forage of the country. As the cultivation of this product is increased, providing sufficient seed is required [1]. Alfalfa is considered as grass legume.

More than 616000 ha area has been cultivated by alfalfa in Iran [2]. Since alfalfa is a cross plant and its pollination is done by the help of wind, bees, pollinator insects and other external elements, the improvement of artificial pollination increases the number of bunches in each bush. In case, this plant cannot pollinate under some different circumstances, the seed production is decreased in the plant [3]. Through studying the onion plants, it has been determined that the pollination done by bees was 25.758 and 44.385% more than artificial pollination (using brush) and control one [4]. Cycocel (ccc) is an onion compound and regarded as most consumed moderator of plant growth especially in Europe and nowadays, is frequently applied to decrease the dormancy and control the germination growth of cultivating plants [5]. Ccc prevents the activities of synthesized anti-covering enzyme and decreases the plant height [6]. Seed performance of plants treated with ccc leads to the increases in root growth and water potential in the leaves [5]. Based on some research results, Cycocel reduces the stem length and enhances the number of seeds in the ears [6].

This paper aims to determine the best concentration of ccc and highest level of artificial pollination in order to enhance the yield of seeds and examine the alfalfa's components and behaviors' reactions in two-purpose (seed and forage) fields.

2. Materials and Methods

This research has been performed in the experimental field of alfalfa's seed production placed in Agriculture Research center of Boroujerd along with wet and cold winter and relatively moderate and dry summer. The desired cultivar was Hamedani alfalfa cultivar. This research has been performed as a plot splitting experiment of completely randomized blocks with three replications and each treatment was implemented in the furrows of 6m long and 2m wide. Control treatments include artificial pollination done by pulling a rope at two stages along with pollination levels of 70 and 100%. 100% non-artificial pollination was done. Solution was sprayed from the height of 25 cm using a crop sprayer at 1 atmosphere pressure. Secondary treatment involves various concentrations of Cycocel hormone (0, 1.6, 3.2 & 6.4 liter/ha). Ccc treatment has been performed by solution-spraying. The targeted features are the bush height and the number of seeds. Then, data were normalized for analysis of variance using $spss_{18}$and sas_9 software. Also, the calculated means have been compared by the means of Tukey test.

3. Discussion

3.1. Height of bush:

Results obtained by analysis of variance indicate that considering the height of bush, no significant variation exists between the levels of artificial pollination.

Hormone treatment has been significant at 5% level but the effects of artificial pollination on hormone are not significant (Table1). Comparing the means demonstrated that the lowest and highest heights were related to the 100% flowering stage and control treatment for the levels of artificial pollination, respectively. Through comparing the hormone level, the lowest height of bushes has been specified for 6.4 liter/ha concentration.

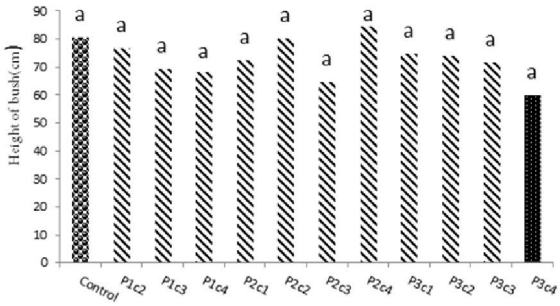
While comparing the means of these two variables' effects using Tukey test at 5% level, the lowest and highest bush heights have been found for 100% flowering stage and 6.4 (liter/ha) hormone level and control treatments of artificial pollination and hormone, respectively (graph1).

Results indicate that the lowest and highest heights have been related to flowing and hormone stages and control treatments of artificial pollination and hormone. Cycocel prevents the lengthwise growth of cells in nodes which is stimulated by Gibberellin hormone, stops the synthesis of ant-enzyme at early stages of Gibberellin biosynthesis and reduces the Apical dominance. Due to preventing the synthesis of Geranyl Pyrophosphate in the cycle of Gibberellin acid biosynthesis, the height of bush is reduced because the longitudinal growths of stem and nodes decrease. However, with regard to these conditions, Cycocel's effects do not always reduce the plant height and are varied in different plants because of various concentrations.

For example, the lack of effects on the length of wheat stem and oat has been reported [7].

Table1: Studied features' analysis of variance

Variation coefficients	Degree of freedom (df)	Height of bush (cm)	Seed number in pod	Seed behavior
Block	2	1013.26	275.85	1.53
Artificial pollination	2	279.95	667.86	45.15
Error of a	4	335.25	103.72	0.81
Hormone	3	543.11	278.43	8.52
Artificial pollination*hormone	6	649.07	4086.92	28.09
Error of b	18	4504.98	73.24	0.272
Cv%	-	12.02	4.49	3.88



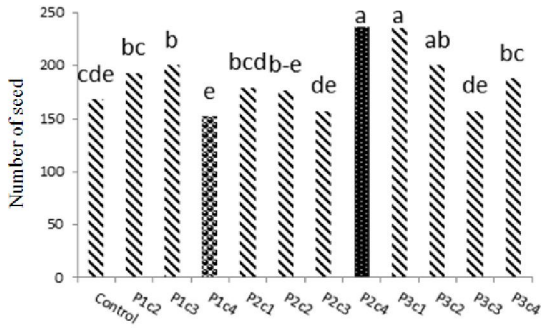
3.2. Graph1: Effects of artificial hormone pollination on the bush height

3.2.Number of seeds: The results of seeds' number given by analysis of variance show that there are significant relationships between artificial pollination and hormone at 5 and 1% levels (Table1). Comparing the means for the levels of artificial pollination presented that the highest and lowest numbers of seeds have been determined for 70+100% artificial pollination and control treatment.

Also, 1.6 and 6.4 (liter/ha) hormone levels had the highest and lowest number of seeds. Regarding the effects of these two factors using Tukey test at 5% level, 70+100% artificial pollination and 1.6 (liter/ha) hormone levels had the highest number and control treatment and 6.4 (liter/ha) hormone level were associated with the lowest number of seeds (graph2).

The research results show that the plants treated with artificial pollination have higher number of seeds as compared to control treatment and as the hormone rate is increased, the number of seeds decreases, especially at 6.4 (liter/ha) hormone level which has increased the establishment of pollen on the flowers at 70+100% level of artificial pollination because alfalfa is a cross plant whose pollination is done by the factors such as wind, bees and insects. In case, it cannot pollinate, it is regarded as a self-incompatible plant.

Consequently, artificial pollination leads to the increase in the number of seeds; on the other hand, Cycocel hormone affects the number of seeds in the ears by increasing them but decrease the number of those in the pods due to the increase in the number of pods in each bush. Because there is a reverse relationship between the number of pods in the ears and number of seeds in the pods and the increase in the number of pods in the ears reduces the number of seeds in each ear while decreasing the level of carbohydrates in the ear. These results are in conformity with those reported in [8-9].



Graph2: Effects of artificial pollination with hormone on the number of seeds in pods

3.3.Grain Yield

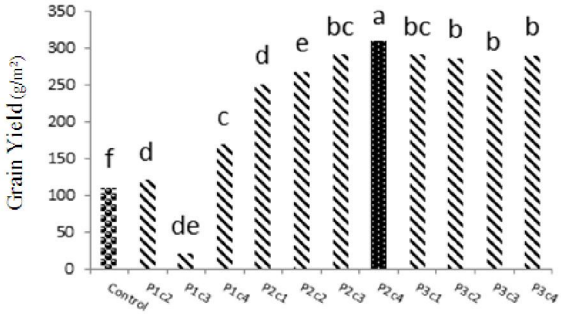
The results related to seed yield and obtained by analysis of variance indicated that artificial pollination and hormone treatments and their interactions at 1% level have a significant variation (Table1).

Through comparing the means using Tukey test for the effects of artificial pollination levels on seed yield, it has been found that the highest and lowest rates were associated with 70+100% level of artificial pollination and control treatment.

Regarding hormone levels, the highest and lowest rates were observed for 6.4 (liter/ha) level and control treatment, respectively. With regard to the effects of these two factors using Tukey test at 5% level, 70+100% pollination and 6.4 (liter/ha) hormone levels had the highest rate of seed yield and the lowest rate was related to control treatments of artificial pollination and hormone levels (graph3).

Results report that the increase of pollination treatment causes the increase of seed yield so that the highest rate of seed yield is seen at 70+100% artificial pollination levels indicating that since alfalfa is a cross plant, artificial pollination treatment enhances the period of pollination, the establishment of pollen on the pollen tube, the formation of seeds and the seed yield. On the other hand, the increase in hormone rate enhances the seed yield because Cycocel reduces the number of seeds in the ears. Though, it increases the number of stems, branches, fertile ears, the height and number of flowering branches and the weight of seeds. Therefore, the seed yield is enhanced and the growth moderator increases the yield through changing Photoassimilates and directing them toward the targeted destination. Cycocel derivations such as Micovat chloride and Mepycowat chloride have a group of Ammonium in their structures which may release nitrogen existing in an Ammonium group after separating them in the metabolic processes and give them to the plant as a nitrogen source.

It stimulates the growth and its dependent indices leading to the increase in the number of pods which can be resulted because of physiological method' s creativity (seeds) before pollination; on the other hand, the increase of seed yield is related to the increase of biological nitrogen performance which is resulted from consuming higher levels of ccc. Therefore, the increase of N contributes to the increase of seed yield. Also, Cycocel decreases the height of plant and increases the vertical growth of branches so that the plant receives much light to do photosynthesis which improves the yield of seeds.



Graph3: Effects of artificial pollination with hormone on the number of seeds in pods

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