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The Effect of Priming Treatment on Yield Components of Pea (Greenaro)

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Abstract: **In order to investigate the effects of seed priming on yield components in pea (Greenaro), an experiment was conducted in January 2013, using a randomized complete block design with four replications. Priming treatments including control (non priming), hydro-priming, priming with Calcium Chloride, Zinc Sulfate, and Potassium Chloride were assigned to subplots. The results indicated a significant effect of the priming treatments on the average number of pod, pod fresh weight, number of grains per plant, average grain weight, germination percentage, the lowest pod distance from land, the biggest pod size, pod total weight, number of pods and grain fresh weight, while, the results indicated an insignificant effect of the priming treatments on the pod dry weight, grain dry weight, protein content, the highest pod distance from land, the smallest pod size. The maximum average number of pod, grain fresh weight, pod number, and pod total weight were observed in the control treatment; the maximum pod weight and number of grains per plant in the Calcium Chloride treatment; the maximum grain weight average in the potassium Chloride treatment; the maximum germination percentage in the Zinc Sulfate treatment; and the maximum pod size in the hydro-priming treatment.**

Key words: Priming, Peas, Germination, Yield Components.

1. Introduction

With a range from 17% of protein, pea is one of the most important farming plants of the legumes family and placed in the third global class among the grains in and placed in terms of production rate(2004,FAO). But, in Iran, it has been placed in the first rank among the cereals in terms of under-cultivation and production level (Banaei, 1998). Earlier settlement of the small plants following the fast germination of seed through acceleration in closing of canopy is one of the effective factors for formation of successful seed yield (Rebetzke et al 2002, Richards and Lukas 2002, Botwright et al 2002, Peltoen-Sainion 1997).
That class of operation of agricultural plant management which support and reinforce the initial growth lead to more production of biomass in the grains probably (Pelton-Sanio 1997). For the first time, Kidd and West confirmed that soaking of seeds for short time periods
has an optimum effect on the percentage of budding and growth of small plants. The next steps and this positive effect are kept to following the drying again. New studies have confirmed this affair so that the soaked seeds compared to not soaked seeds germinate with more speed. Fast germinating and even sprouting is necessary for successful settlement of the farming plant in two tension and lack-of-tension conditions (Ashraf and Foodlad 2005). It seemed that seed priming increases germination rate through decrease of damage to proteins RNA and DNA (Koohler et al 1997, Bray 1995 and Froog et al 2009). It has been recorded that following seeds priming (lettuce, tomato, leek, wheat and corn), cellular synthesis and division increases. Increase of activity of phosphatase enzyme has been reported under priming treatment (Abbasdokht et al 2009). Positive and diversified effects of priming on the yield components of forming plants in different places, due to difference in the environment condition are of special importance. Therefore, this research studies effect of priming treatments on the yield components of the pea in Tonekabon region.

2. Materials and Methods

This research is conducted in an experimental farm in 5 kilometer away from south east of Tonekabon with geographical coordinates (longitude and latitude) of 52' and 50" (eastern longitude) and 49' and 36'' (northern latitude) and sea level high of 20 meters lower than free sea level in October 2013.
Average annual rainfall (thirty-year statistics of meteorology) was reported 1330m/l and maximum temperature and minimum temperature was reported 20% and 14.2C. Humidity daily fluctuations are available in the rage from 62% t0 94% which August has minimum relative humidity and March due to winter rainfall has maximum related humidity soil of experimental farm-with silly-sandy texture had soil PH of 7.6, soil electrical guidance of 0.37 M/mos and 0.12 of electrical material and its absorbable quantity of phosphorus and potassium was 100 and 1 parts per million. Priming the treatment of the seeds are as following:

1- Without(non) priming treatment(control)
2- Soaking of the seeds in the distilled water(hydrorimimg) for 12 hours(Farooq et al 20070
3- Soaking of the seeds in the potassium chloride with osmotic potential of 1.2 Megapascal for 24 hours (Farooq 2006 and 2007).
4- Soaking of seeds in the calcium chloride with osmotic potential of 1.2 Megapascal for 24 hours(Farooq 2006 and 2007)

5- Soaking of the seeds in the 0.05 zincsulfate for 24 hours(harris 2006)

It is required to mention that time of implementation of priming treatment has been accomplished considering the suggestive result of the other researchers. Priming treatment with ratio of one to four seeds and priming solution of these seeds were extracted from inside the solution and washed by distilled water and then dried.

Each experimental plot included four-three-meter-lines with 40cm interval. Distance of bush on the lines was considered 20 cm with density/accumulation of 12 bushes per square meter. After planting, testing plots relied on the plants need were irrigated once every 7 days, and the weeding operation were carried out once every 15 days at beginning of the plants growth manually. Final harvest was concluded on the basis of arriving of the seed to 65% of the plants dry materials. In each time of sampling from 20 bushes every plot, edge of plot was harvested following the omission of the one meter of the lines and transferred to laboratory in order to measure the tested attributes (table 1). In order to investigate germination percentage, 25 seeds from each treatment were placed in to the glass petridished between two layers of the sieve paper 10m/l of the distilled water was added to each petridish and then they were transferred to laboratory in order to 25-30 C germinator for germination. After passage of a week, number of the germinated seeds was counted. Then through the following formulae rate of percentage of Namieh Power was obtained:

$$\textbf{Germination \%} = \frac{\text{Number of germinated}}{\text{Number of planted seed}} \times 100$$

In order to determin3 percentage of the seeds' protein, amount of 0.25 gram of the seed sample from each repetition was ground inside the Chinese mortar first with aid of liquid nitrogen and then 1 m/l of 50 milli molar potassium phosphate buffer (ph=7) containing 1 molar EDTA was added to it. The achieved product was centrifuged in 4C with 14000 r Pm for 20 minutes using expender 5417 R model refrigerator-possessing centrifuge; then surface solution was isolated by sampler and centrifuged once again in 4 C with 10500 rpm for 10 minutes. Later the surface solution was used to assess concentration of the soluble protein. In order to assess concentration of soluble protein available in pea seeds, standard protein of bovine serum albumin (BSA) was used. It is in such a way that, at first, 2 mili-grams-per-milliliter concentration of bovine serum albumin (BSA) was dissolved in 1 milliliter of the distilled water. Then, we dissolved 0.05 milliliter of the first standard solution in 0.5 milliliter of the distilled water, and 1 milliliter-per-milliter concentration(the second standard solution) was provided and other standard solutions with concentration of 0.5,0.25,0.125 and 0 milligram were prepared in such a way. Then, test pipe was prepared as per requested number and added to each 2.5 milliliter of the Brodford solution. To each one of these pipes, 50 micro-liters of the high standard solutions and extracts containing protein were added and vortexed for per 25 to 30 seconds and placed in darkness for 15 minutes. Absorption of the samples in the wavelength of 595 nanometers was read by use of UV/VIS spectrophotometer apparatus. Considering absorption of standard protein, the standard curve was drawn and concentration of the samples' protein was calculated by the obtained line equation.(Brandgord 1976) analysis of data was carried out using M Statc statistical software. In order to compare the averages Danken multi-amplitude test in 5% probability level has been used.

3. Results and Discussion

With regard to the variance analysis table (table 1),priming affects was significant on the majority of the studied attributes, including average number of pod, pod fresh weight, number of grain in bush, average grain weight in plant/bush, germination percentage, the lowest pod distance from land, the biggest pod size, pod total weight, number of pod, and grain fresh weight. And attributes such as pod dry weight, grain dry weight, protein percentage, the highest pod distance from land and smallest pod size were insignificant. Considering table of average comparison (table 2) it can be said in various treatments, that maximum average number of pod related to control treatment in quantity of 16.58 and minimum average number of pod related to zinc sulfate treatment in quantity of 12.18 which was contrary to the results of Harrris et al 2008. Regarding effect of priming on the pod fresh weight, it can be said that maximum pod fresh weight related to the calcium chloride treatment for amount of 508/0 and minimum pod fresh aid weight related to potassium chloride treatment for amount of 359.8. During some experiments, Fatah et al (2011) and also Salimi et al (2011) indicated that pea seeds priming leads to an increase as much as four times of yield/performance as well as an increase of pea pods weight. Concerning effect of priming on the number of grain per plant, it can be said that maximum number of grain per plan related to calcium chloride treatment in quantity of 78.5 grams and its minimum number related to the zinc sulfate treatment in quantity of 50.5.J.et al (2002) and Fo. Et al (1988) reported that priming, through settlement of small plant in social leads to product increase. On one hand some researchers have been also shown that osmo-priming treatments with low osmotic potential lead to damage to proteins and decrease of germination.(Capron et al 2000). Regarding effect of priming on average grains weight for plant, it can be said that maximum average grains weight per plant related to zinc sulfate treatment in quantity of 0.828 grams and its minimum average grains weight per plant related to distilled water treatment in quantity of 0.40 grams. During some tests, Moso et al (2007) and Rashid et al(2004) showed that primed seeds of pea had the less rot disease up to 37%, and average seed yield increases at rate of 33%; therefore resistance to disease can be due to faster sprouting and quicker development of the root system. In connection with effect of priming on the germination percentage, it can be said that maximum germination percentage related to zinc sulfate treatment for amount of

88.38 grams and minimum germination percentage related to calcium chloride for amounts of 85.88 grams.

Within some experiments Rajiani et al showed that salinity of calcium chloride decreases seed germination percentage. Also, Beheshti et al(2001) indicated that by increase of salinity germination percentage and speed had a decreasing process for all cultivars of alfalfa. Axon et al revealed that zinc sulfate treatment improved germination percentage and settlement of beet seed in the farm conditions which this subject can be due to better water absorption by the seed. Regarding effect of priming on the lowest pod distance from land, it can stated that maximum lowest pod distance from land related to the control treatment in quantity of 10.63 cm and minimum lowest pod distance related to the calcium chloride treatment in quantity of 6.88 cm. Considering effect of priming on the biggest pod size, it can be expressed that maximum biggest pod size related to distilled water treatment at rate of 12.75 cm and minimum biggest pod size related to calcium chloride treatment at rate of 10.40 cm. In connection with effect of priming on the total weight, it can be said that maximum total weight related to control treatment for amount of 1287.5 grams and minimum total weight related to distilled water for a mount of 728.8 grams. About effect of priming on the number of pod, it can be asserted that maximum number of pod related to control treatment in quantity of 249 pods and maximum number of pod related to zinc sulfate treatment in quantity of 183 pods. Concerning effect of priming on the grain fresh weight, it can be expressed that minimum grain fresh weight related to control treatment in quantity of 579.5 grams and minimum grain fresh weight related to zinc sulfate treatment in quantity of 357.8 pods. In an experiments, Khodabakhsh et al (2011) and Fateh et al (2011) showed that calcium chloride and zinc sulfate treatments have allocated the minimum rate of grain dry weight to themselves. With regard to the table of average comparison(table 2), it can be stated that effect of various priming treatments on the attributes, including pot dry weight, grain dry weight, the highest distance from land, the smallest pod size and protein percentage was not significant, even though some differences among the treatments were observed. For example, in connection with effect of priming treatments on the grain protein percentage, it can be said that maximum average protein percentage related to zinc sulfate at rate of 52.27 grams and the minimum average protein percentage related to calcium chloride at rate of 14.64 grams.

4. Conclusion

Result of this experiment show significant effect of the priming treatment on the majority of yield components in the pea grain, including average number of pod, pod fresh weight, number of grains per plant, average grain weight per plant, germination percentage, the lowest pod distance from land, the biggest pod size, pod total weight, number of pod, and grain fresh weight, and they indicate an insignificant effect of priming treatments on the attributes such as pod dry weight, grain dry weight, protein percentage/content, the highest pod distance from land and the smallest pod size. The maximum average number of pod, grain fresh weight, pod number and pod total weight have been observed in control treatment; the maximum pod fresh weight and number of grains per plant have been observed in a calcium chloride treatment, the maximum average grains weight per plant has been observed in potassium chloride treatment; the maximum germination percentage has been observed in the zinc sulfate treatment and the biggest pod size has been observed in the distilled water treatment.

Appendix:

Table number 1: Variance analysis of priming effect on the yield components in pea(Greenaro)

						Average Square				
Source of changes	**df**	**The lowest pod distance from land**	**Germination percentage**	**Protein Percentage**	**Mean (weight)**	**N**	**Grain dry weight**	**Dry weight**	**Fresh weight**	**Average number of pod**
Treatment	4	8/71 **	3/86 *	0/215 ns	0/127 **	401/95 *	1/80 ns	3.50 ns	13561 **	11/20 *
Block	3	0/25 ns	2/58 ns	0/280 ns	0/009 ns	282/05 ns	1/73 ns	3/80 ns	4818 *	12/65 *
Std error	12	1/47	1/13	0/255	0/011	129/22	3/90	5/47	864	2/45
Std	-	14/36	1/22	3/38	17/51	17/72	4/91	7/67	6/93	10/62

ns * ، **a are significance in the probability level of 1% and 5% and lack of significance -1.5=using LSD test, respectively

Continuation of table No 1: Variance analysis of priming effect on the yield components in pea(Greenaro)

			Average **Squares**				
Source of changes	**df**	**Fresh grain weight**	**N**	**Total weight**	**The smallest pod size**	**The biggest pod size**	**The highest pod distance from land**
Treatment	4	33568 **	2503 **	204020 **	0953 ns	4/009 **	10/36 ns
Block	3	9000 *	2311 *	13161 ns	0/742 ns	2/62 *	7/81 ns
Std error	12	2846	455	7534	0/754	0/54	5/52
Coefficient of changes	-	10/70	9/64	8/09	15/22	6/02	13/37

Table number 2: A comparison of average effect of priming treatments on the yield components in pea (Greenaro)

Priming Treatments	**Germination percentage**	Grain **weight average in plants (g)**	**Protein Percentage**	**N**	**Dry grain weight (g)**	**Dry pod weight (g)**	**Fresh pod weight (g)**	**Average number of pod**
Control	87/88 a	0/495 b	15/03 a	64/50 ab	40/25 a	30/75 a	452/5 b	16/58a
Calcium chloride	85/88 b	0/549 b	14/64 a	78/50 a	39/50 a	29/00 a	508/0 a	15/73 a
Zinc sulfate	88/38 a	0/828 a	15/27 a	50/50 b	39/75 a	30/25 a	385/3 cd	12/18 b
Distilled water	87/25 ab	0/400b	15/01 a	65/75 ab	41/25 a	31/25 a	416/0bc	14/25 ab
Potassium chloride	88/00 a	0/748 a	14/87 a	61/50 ab	40/25 a	31/25 a	359/8 d	14/94 a

The column with joint/common letters suggests lack of significance using LSD test.

Continuation of table number 2; A comparison of average effect of priming treatments on the yield components in pea (Greenaro)

Priming Treatment	Pod weight)g(	N	Total weight) g(	The smallest pod size(cm)	The biggest pod size(cm)	The highest pod distance(cm)	The smallest pod distance (cm)
Control	579/5 a	249 a	1287/5 a	6/00 a	12/65 a	18/25 ab	10/63 a
Calcium Chloride	465/5 b	236 ab	1210/8 a	5/25 a	10/40 b	17/88 ab	6/88 c
Zinc sulfate	357/8 c	183 c	966/3 b	6/38 a	12/65 a	14/75 b	7/38 bc
Distilled water	514/5 ab	214 bc	728/8 c	5/65 a	12/75 a	18/25 ab	9/00 ab
Potassium Chloride	575/0 a	224 ab	116/88a	5/25 a	12/58 a	18/75 a	8/25 bc

The column with joint letters represents lack of significance using LSD experiment.

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