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The effect of Zinc(Zn) spraying and plant density on yield and yield components of green gram

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ABSTRACT

To investigate the effect of Zn spraying and plant density on thousand seed weight(TSW), biological yield, seed yield, harvest index(HI) , straw yield and seed protein yield in green gram crop, an experiment was conducted in summer 2010 in Koohdasht. Experiment was performed in Split plot randomized complete block design with three replicates. Fertilizer application on three levels of control (spraying water), applied in a rapid growth phase and two times spraying with two in thousand concentration of Zn fertilizer was considered. The results show the superiority of TSW, seed yield, HI and seed protein present in spraying method. Analysis of variance showed that the effect of plant density on seed yield, biological yield, HI and protein content was significant and the highest yield of 1787.5 kg /ha was obtained to density of 33 plants per square meter and once spraying that this treatment is justified for the region.

Keywords*:* green gram, residue management, planting method, Zn spraying, seed yield

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INTRODUCTION

Deficiency of micronutrients in plants and crops has expanded globally. The unit is about 30 percent of the world's soils are deficient in iron and zinc. Micronutrients in the biochemical plant cells action have indispensable role [9]. Very little Zinc is needed for the plants, and the focus centers on the tasks, like many other micronutrients in plants are unknown. But of necessity it can be measured on its lack of side effects. Appears Zinc in formation and growth hormones, elongation of the nodes and in the chloroplast and starch grain is effective. Zinc for the enzymes that synthesize tryptophan, which is a prerequisite for the production of auxin is essential. Cereals bud such as wheat , lentils and green grams are rich in zinc (zn) is that its deficiency causes loss of appetite, vision problems and is slowly healing and anemia is the consumption of green gram buds appropriate ways of providing it. Spraying micronutrient is for the growth of green grams and its quality [5]. Ganjali et al (1998), studied on the reaction of seed yield and morphologic properties in green gram varieties to plant design and plant density. The results showed that although the yield per plant with decreasing density increased, but this increase failed to compensate for the lack of plant unit but this increase failed to compensate for the lack of plants per unit area and yield response to increasing density was positive. Grewal and Williams (2000) expressed the yield components of green gram crop factors are most affected by plant density .Hayat et al (2003) The effect of different planting densities on green gram protein genotypes were investigated. In this experiment, the effect of different distances between plants was significant. On seed yield and protein were also expressed that by reducing the distance between rows of plants on total dry weight, leaf dry weight, leaf area index and crop growth rate increased but the relative growth rate and net assimilation rate was reduced. Rezvani Moghaddam and Rahimian Mashhad (2000) were exam the effect of density

and row spacing on yield and yield components of green gram. The results showed that plant density increases from 6 to 20 plants have a significant effect on yield and yield components in green gram. Koochaki and Rahimian (1996), the test showed that the highest seed yield obtained from the distance between the rows of 55cm and under rows 5 cm. Taleie et al(2000) showed that the highest yield in green gram varieties of planting obtained from planting design with distance between rows of 55cm under rows of 5cm 5. Thus increasing plant density was caused increased seed yield, and it's related to increasing the number of plants per unit area and increased solar radiation absorbed by a plant [6-13]. Torabi Jafroodi(2003) showed that with increasing in plant density, the solar radiation absorbed by the canopy was more increased and therefore, morphological yield was increased.

MATERIALS AND METHODS

This experiment was performed in the 2010 summer in the city of koohdasht-Lorestan with latitude 41° and 50' North and longitude 28° 35' East, with an average annual temperature16.8 and average annual rainfall of 159.8 mm .According to the division of geographical regions this region has subtropical climate with half hot summers and dry. The experiment was performed using to the split (split plot) design in the randomized complete block mold in 3 replications and 27 plots. The density in three levels (a1:10 cm, a2:7.5cm, a3:5 cm) as the main factor and were selected the Zinc spraying in a dose of two thousand at 3 levels (b1: zero, b2: once spraying, b2: three times spraying) as sub-factor. First, in order to awareness of the soil physico-chemical traits of the territory take a sample of composite and after the analyzing, the recommendations chemical fertilizers consumption based on the lab.

In order to planting in the last year, a deep plowing was done and caused that previous crop residue went under the soil and were very rotten and more water is sorted in the earth. In the spring of next year we have a deep drive to break up the clog and weed away and after the teeth and taking action to collect the weeds and after were planted. Each treatment or sub-plots consisted of six planting line of length with 5 meters and the distance between lines 40cm, 2 meters space between replications. In this research, we used Partov variety that it is standing growth, high resistance to loss, diseases and pests and it placed in groups of early cultivars. The harvest was doing of four lines of the middle by omitting half a meter of each line side (to sake removing the margin effect). The experiments were performed in year 2010 during the summer growing period. Analyses were performed with a personal computer using the MSTATC software and for design the diagrams used the EXCEL software. In addition the Duncan's Multiple Range Test (DMRT) (P = 0.05) was used to conduct mean comparison of treatments and find significant differences among means.

Table1: Soil characteristics of the experimental site in Koohdasht, Iran where the experiment was conducted.

	soli particle(%)			Lime	EC	K(ppm)	P(%)	C(%)
	sand	silt	clay					
	22	53	25	42.2	0.63	195	4.2	1.03
	Texture			PH Ppm	Cu Ppm	Zn Ppm	Mn Ppm	Fe Ppm
	silty loam			7.9	0.88	0.44	4.6	4

RESULTS AND DISCUSSION

Thousand seed weight (TSW)

Between density treatments there were highly significant different (table 1). The highest TSW was obtained of 50 plants per square meter (38/6 g) and the minimum plant density of 33 plants per square meter. Low number of pods per plant at high density, allowing a greater number of seeds per plant and transfer of photosynthesis materials into seed provides and increased seed weight. Other researchers (Majnoon Hosseini, 1996 - Rezai and Hassanzadeh, 1997) also reached the conclusion. Among Zn spraying treatments applied, there was a significant difference and maximum TSW (37.9 grams) of the treatment was applied twice. Zn is an important element in constitute of seed and increased of seed weight because of its impact on reproductive processes and materials are making. Interaction of Zn spraying and plant density on TSW was significant. In addition, maximum TSW (41.1 g) was obtained from 50 plants per square meter and once spraying.

Table 2: Factorial analysis of variance components (density, spaying, and their interaction)for assessed traits.

S.O.V	df	TSW	Biological yield	Seed yield	HI	Straw yield	Seed protein yield
Replication	2	1.287^{ns}	2385070.255^{ns}	177464.234^{ns}	0.179^{ns}	95132.328^{ns}	127405507.282^{ns}
Density(a)	2	32.493**	10586985.299**	432046.565*	169.658**	4092031.024**	200131955.613^{ns}
Error	4	0.495^{ns}	574473.536^{ns}	75311.295^{ns}	1.925^{ns}	188703.485^{ns}	41622936.586^{ns}
Spraying(b)	2	12.185**	3931376.954*	190424.869^{ns}	115.470**	3896378.534*	130100887.950^{ns}
a*b	4	20.190**	2890766.549*	278080.351*	21.525**	3291391.822*	133689225.413^{ns}
Error	12	0.814	874899.766	73790.073	2.026	614535.281	46514023.103
CV		2.46	19.85	19.70	5.72	22.02	19.89

,significant at 5 and 1%,NS:not significant*

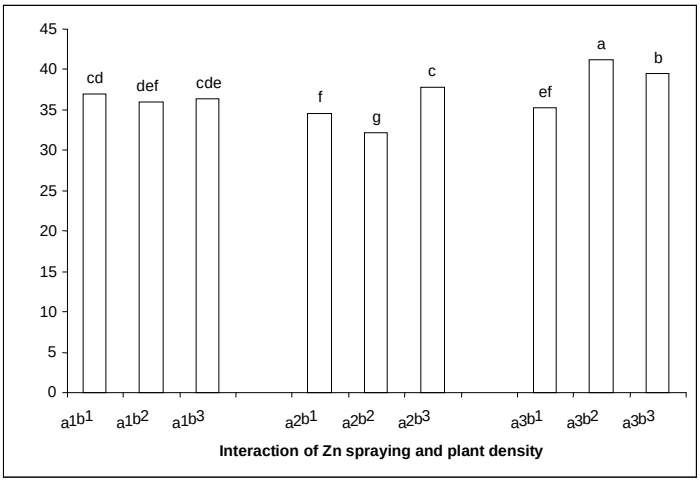

Figure 1-Interaction between Zn spraying and plant density on TSW

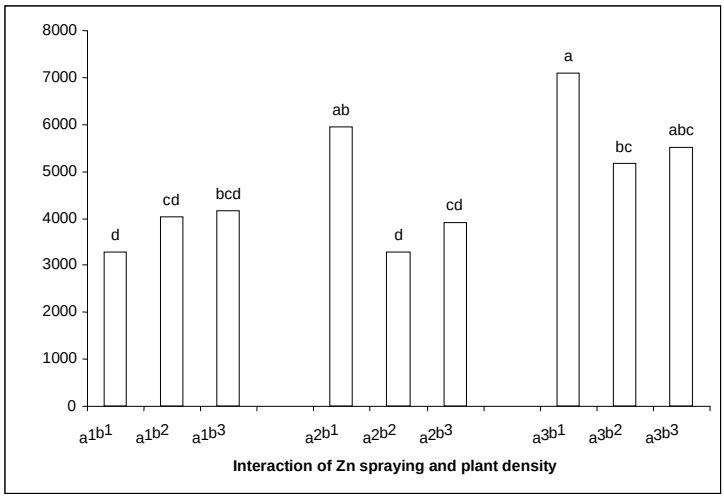

Figure 2- Interaction between Zn spraying and plant density on biological yield

Biological yield

The results of variance analysis of the effect of plant density on biological yield Statistically significant difference exists (table 1). Mean comparison showed that the highest biological yield is related to 50 plants per square meter production with 5923.6 kg/ ha production was obtained. More density of plant due to the increasing number of plants per unit area, leading to the production of dry matter is greater in the treated (Vidbadmar et al, 1984)

There was a significant difference between Zn spraying treatments on biological yield of green gram and the maximum biological yield (5445.8 kg/ ha)was obtained from control. Interaction between Zn spraying and plant density on the biological yield was significant. In addition, maximum biological yield (7104.2 kg/ ha) was obtained from 50 plants per square meter without spraying (figure 2).

Seed yield

The results of variance analysis of the effect of plant density on seed yield statistically had significant differences (table 1). Mean comparison showed that the highest yield was obtained from density 33.3 plants per square meter with the production of 1611.1 kg/ ha. Other researchers, including Sing et al (1998), or Dow et al (1988) expressed that yield can be affected by plant density.

Between Zn spraying treatments on the yield of green gram was significantly different and the highest of seed yield was obtained of once spraying (figure 3). Interaction between Zn spraying and plant density on seed yield was significant and the maximum seed yield (1787.5 kg/ ha) was obtained from 33 plants per square meter and once spraying. This was probably due to increased dry matter by applied spraying and the result will be increased yield.

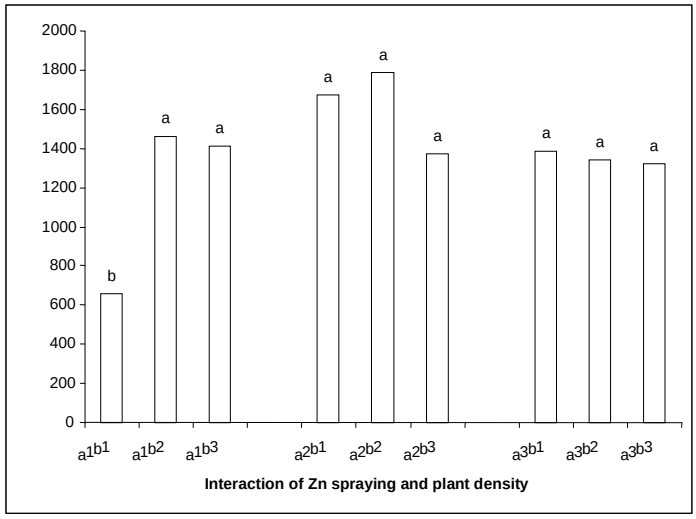

Figure 3-Interaction between Zn spraying and plant density on seed yield

Harvest index (HI)

According to the result of analysis variance, the effect of plant density on harvest index was significant and maximum harvest index (28%) was obtained from 50 plants per square meter (table 1). There was a significant difference between Zn spraying treatments on harvest index, and maximum harvest index 28.29 percent owned treatment once spraying (figure 4). Zn spraying with increasing leaf area due to increasing radiation [12]. Zabet et al(2005), Michail (2004) showed that spraying caused increased in harvest index.

Straw yield

The results of variance analysis showed that the effect of plant density on straw yield had statistically significant difference (table 1). Mean comparison showed that the highest straw yield was obtained from the density of 50 plants per square meter with 4315.2 kg/ha production (figure 5). In review Soccer et al (1993) also with increasing in plant density per hectare straw yield was increased. Between Zn spraying treatments on straw yield, there were highly significant differences. Interaction between Zn spraying and plant density on straw yield was significant. Maximum straw yield and (5718.7 kg /ha) was obtained from 50 plants per square meter and without spraying.

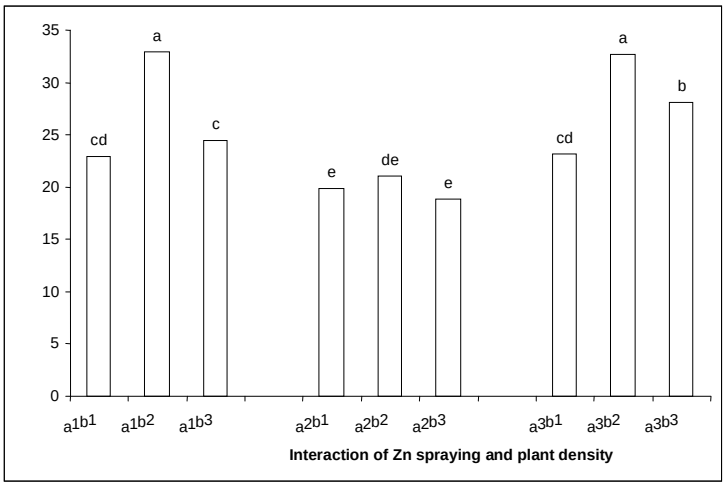

Figure 4 - Interaction between Zn spraying and plant density on harvest index

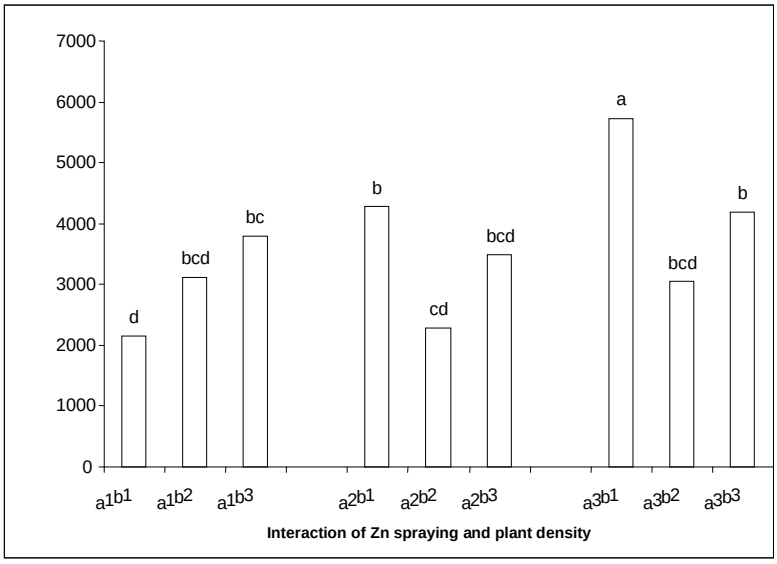

Figure 5- Interaction between Zn spraying and plant density on straw yield

Seed protein yield

The results of variance analysis showed that the effect of plant density on seed protein yield had statistically significant differences (table 1). Mean comparison showed that the highest yield of seed protein was obtained from 33 plants per square meter with the 390 kg /ha production. There was a significant difference between Zn spraying treatments on seed protein yield and maximum yield of protein, in green grams (379.3 kg/ha) was obtained from once spraying (figure 6) .This results is consistent
of Brennan (1993).

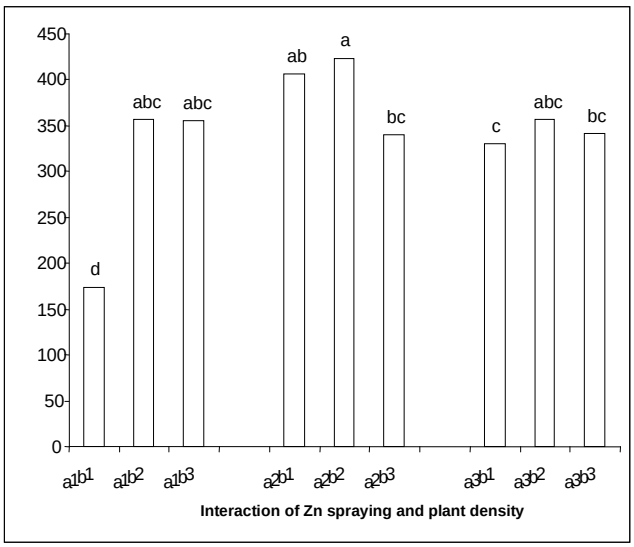

Figure 6 - Interaction between Zn spraying and plant density on yield seed protein

CONCLUSION

The results of variance analysis of the effect of plant density on seed yield had statistically significant differences. Mean comparison showed that the highest yield was obtained from density 33 plants per square meter with the production of 1611.1 kg/ ha. There was significantly different between Zn spraying treatments on seed yield and maximum seed yield of green gram (1529.8 kg/ha) was obtained from once spraying. Interaction between the Zn spraying and plant density on seed yield was very significant and maximum seed yield (1787/5 kg/ ha) was obtained from 33 plants per square meter and once Zn spraying. In addition, with increasing density of 33 plants per square meter and with less density of 33 plants per square meter in order to increase competing and decrease in number of proper plant in low densities seed yield was decreased.

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