Effect of plant density on percent of remobilization, chlorophyll content, light penetration rate and effective grain filling period of chickpea (*Cicer arietinum*) in dry farming

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Abstract: One of the ways is to increase yield Chickpea, determine the appropriate density and plant varieties. This study aims to determine the effect of three planting densities (25, 50, 75 plants per square meter) on some morphological characteristics such as percentage remobilization of stem, leaf chlorophyll content and grain filling process pea cultivars include: ***Arman, Hashem, ILC482 and Greet*** (Local varieties) Was. Factorial experiment in randomized complete block design with three replications at the Agricultural Research Station in Khorramabad 2005-2006 was conducted. If plant density decreases leading to increased chlorophyll content of leaves was chickpea. On the other hand at low planting densities, due to less competition between plant so number of branches per plant, stem remobilization and percentage light penetration significant increase ($P \leq \%1$) were. Most effective grain filling period (***EFP***) to ILC482 variety approximate was 26 days. The least of ***EFP*** to Hashem variety approximately was 26 days. Density of 25 plants /m^2 on the highest floor canopy light penetration and density 75 plants /m^2 at the bottom of the lowest penetration of light Canopy included.
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1. Introduction

Beans, the second important source of food grain are known. Grain legumes, with 32-18 percent protein plays an important role in supply protein can have a human need and as a complementary and balanced cereal grains that contain 12-9 protein are considerable role in human nutrition play(5).

Fayaz Vayshya and judge (1992) expressed that they pea leaf chlorophyll content were significantly affected by different seed rates 90 and 120 days after sowing was. These results showed that 75 and 100 kg seed ha significantly higher chlorophyll content than the rate of 125 kg seed per ha during the desired time had (12). Dutta and Lahiry (1988) and majnon Hosseini and colleagues (2002) were also expressed that with increasing density, leaf chlorophyll increased to a Optimum failed (1, 5).

Appropriate density change within species competition improved growth characteristics and yield increase. Khajehpour (1996) several studies have shown that between the number of secondary branches and plant yield is directly related to positive (3). Watt and Singh (1992) Expressed density, the number of secondary branches and thus the number of pods am able this category affects deficiency conditions and plant number per unit area yield of chickpea increased branch cannot compensate the decrease Saxena and colleagues (1995). Also expressed in the grain, unlike grain, reducing the density increase is not sub-branches (9).

This means that little number of plant unit area through increased compensation secondary branches, but what form that will change is faster than sub-branches. Mackenzie and Hill (1995) expressed that they plant density canopy floor in light transmission plant is effective in chickpea plant density 15 m 40% radiation reaches the floor Canopy but increased density to 60 plants per square meter of floor radiation only 28% shade save the plant seems Majnon Husseini and colleagues (2002)(5, 6). In a study this transmission in chickpea shoot dry matter showed that the mean dry stem this transition between the flowering and maturity time in about 18 to 30 percent is compensation and stability of the main function of this group of plants is the number of pods category. The purpose of this density effect and interaction of cultivar and its growth characteristics, percent of this transfer, the rate of leaf chlorophyll content in light penetration Canopy floor and grain filling process in the Dry land planting is autumn(5, 6).

2. Materials and Methods

In this experiment farm from 2005-2006 Agricultural Research Station SARAB CHANGAHII Khorramabad city was conducted. Khorramabad city with latitude 33 degrees 29 minutes north and longitude

48 degrees 18 minutes east of the prime meridian located and its height above sea level is 1170 meters and the mean annual rainfall statistics based on 35 years 520.5 mm and the mean temperature 17.5 º C is. In this experiment, statistical factorial design in terms of equal importance in the form factors evaluated randomized block design with three replications was used. Factors were the four cultivars of chickpea cultivars ***Arman, Hashem, ILC482*** and ***Greet local*** mass density and three levels 25, 50, 75 plants per square meter. Each plot size 2.4 × 6 m and the number 9 line planting distance lines in each plot was 30 cm percent this transfer using stem Mitsuru and colleagues (1991) the following formula and the difference between stem dry weight flowering stages (maximum) and maturity (at least), respectively. In each of the stages of flowering and maturity of a sampling area of a square each treatment withdrawal (from the second row) and only the stem dry weight (without leaflets) were terms.

With the plant to the flowering stage (90 percent flowering) light intensity at floor level when the afternoon sun Canopy Control unit field model loi lx carefully a luxury (lox) was measured and recorded. Calculate the amount of leaf chlorophyll SPAD device Minolta502 model was used. This was the measuring of the 10 plants selected from each plot and leaf chlorophyll content determined by the device and its average for each plot, respectively. They then compared the mean and statistical analysis was performed. Evaluate grain filling rate (b) and effective grain filling period (EFP), two weeks after the flowering stage and started 5 set pods sampling interval was 5 days of each other. Every step of the 10 plants harvested per plot and all its seeds and pods separated for 24 hours at 65 ° C dry temperature and then weighing times grams per plant single mean was calculated. Then to calculate grain filling rate and effective grain filling period of this formula was used:

Final weight = EFB × β

EFB: Effective grain filling period

β = grain filling rate seed weight

β = maximum transfer rate of Assimilate to grain

Of the formula:

x = total number of days of sampling is usually based on placing the base after flowering or pod formation is.

y = weight of grain in each sample

n = number of count samples

3. Results and Discussion

Analysis of variance showed that the density of plant height was not significant. Although the expected high density due to competition for light increases plant height, but apparently this experiment provides enough light and there is competition for it. That the difference in height which results Fallah and colleagues (2001) standards. Comparison with the mean figure is all Hashem 53.55 cm with a mean height and the highest figure grit with the lowest average 44.91 cm height is able table (2). Since the height due to genetic differences between cultivars are available, most being the height and ideal figures Hashem can probably be attributed to their genetic potential. Because plant height was more related to plant genetic and environmental factors are less affected will be less and plant height can grit m explained that due to similar results obtained by Fallah Saxena N.P. and A.K. Sheldrake. 1980.

Density of the number of branches at 1% level is very significant. Comparison shows that the mean density of 25 plants per square meter with the mean 11.2 and the density of 75 plants per square meter with a mean 4.71 the highest and lowest rate of production have had sub-branches. Because with increasing density, the number of main branches and sub-branches decreased the number of results Romania, Alicante and colleagues (1998) standards. Reduced number of lateral branches with increasing density due appearing over the competition is a high density of growth factors. Enough space in low density and water and enough food in to the plant and therefore will plant can produce more number of lateral branches can but due to high density speed competition at the time expected to produce sub-branches, the number of branches main branches to be more affected.

Comparison shows that the mean number ILC482 mean 9.18 digit branch and Hashem mean 6.5 Branches, respectively the highest and lowest numbers of secondary branches are having. Number of branches in plants is genetic trait that somehow time will be influenced by environmental factors.

In fact determines the type of growth is the number of secondary branches. Umbrella, such as growth in the number of cultivars with more lateral branches growing cultivars with type stands. Digit growth ILC482 type umbrella terms such as having the highest and lowest number of secondary branches is height. If the figure Hashem with long standing type the lowest and the highest number of secondary branches was the height. Comparison shows that the mean density of 25 plants per square meters this transition with the highest average 0.428 and the density of 75 plants per 302 square meters with mean 2428 the lowest transmission won this Table (1). In other words, increasing density and decreasing ability to compete due to plant photosynthetic material transfer to the reproductive organs at the end of the growing season reduced the frequency of encounters with Thompson and Martin (1995). During the study showed that the pea density increased the percentage of

carbohydrates to the tank at the end of transmission season is facing significant growth reduction. Mean comparisons showed that the highest ideal figure this means 426% transfer and transfer this figure Hashem lowest mean 0.284 is having the ideal figure due to photosynthesis of green plant material transfer Manufacturer higher photosynthetic and reproductive organs to Therefore; with this percentage transmission is highest. Hashem, and contrary ideals with figure lower extremities, thus photosynthetic material transfer to reproductive organs and ultimately percent less this transfer is less.

$$b = \frac{\sum xy \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

Table 1: Comparison of mean grain yield and some morphological and physiological traits at different planting densities, **Density= A p/ m2, yield=B kg/ ha, number of branches=C, high=D percentage of leaf chlorophyll=E, Remobilization=F, transfer of light penetration to the floor canopy=G**:

A	B	C	D	E	F	G
25	*a* **1645/24**	*a* **11/12**	*a* **1/5**	**49/9** *a*	*a* **0/428**	**4310/5** *a*
50	*b* **1500/54**	*b* **7/02**	*a* **2/04**	**46/36** *a*	*b* **0/346**	**3300/83** *b*
75	*c* **1369/82**	*c* **41/74**	*a* **1/95**	**49/88** *a*	**0/030** *c*	**2428/5** *c*

Table 2: Comparison of mean grain yield and some morphological and physiological traits in varieties planting, **Varieties=A, yield=B kg/ha, Total leaf chlorophyll=C, branches=D, high=E, percentage remobilization=F, transfer of light penetration to the floor canopy=G:**

A	B	C	D	E	F	G
Arman	*b* **1510/09**	*ab* **7/21**	**3/15** *a*	**49/98** *ab*	*a* **0/426**	**3512/22** *a*
Hashem	*c* **1329/57**	*b* **6/5**	**1/99** *a*	**53/55** *a*	*a* **0/284**	**3208/88** *a*
ILC482	*a* **1650/90**	*a* **9/18**	**2/33** *a*	**45/47** *bc*	*bc* **0/337**	**2910/22** *b*
Greet	*b* **1503/62**	*ab* **8/69**	**1/88** *a*	**44/91** *c*	*bc* **0/309**	**3754/44** *a*

Comparison shows that the mean density of 25 plants per square meter on the highest floor Canopy light penetration and density of 75 plants per square meter of light in the lowest floor Canopy includes Mackenzie and Hill (1995). Plant density was expressed on the floor of the light transmission rate canopy plant is effective. The density of pea plants in 15 square meters floor to 45% radiation reaches Canopy but increased density to 60 plants m only 28% radiation reaches the plant floor Canopy Saxena and Sheldrake (1980). Were expressed that increasing plant density through Canopy radiation absorption increases. Comparison shows that the number ILC482 lowest penetration of light in the floor Canopy are more reasons, growth rate and thus less light penetration in the plant floor is canopy.

Comparison shows that the mean density of 50 plants per square meter leaf chlorophyll highest mean 2.04 and density of 25 plants per square meter with the lowest leaf chlorophyll mean 1.34 is having law and Lahyry (1998) and Majnon Hussein and colleagues (2002). Those were expressed with increasing density, leaf chlorophyll to a much increased Optimum failed. This experiment also the density of 25 plants per square meter density 50 plants m had increased leaf chlorophyll content and Optimum point reached, but density of 75 plants per square meter leaf chlorophyll content to 50 plants per square meter density that can be reduced due plant internal factors effect plant competition for soil nutrients are absorbed. Among cultivars ILC482 figure was the highest leaf chlorophyll content.

Sigmoid a grain growth process and this process will follow three courses of growth (log), or rapid linear growth period (lag) and maturity stage (Maturation) is divided into periods of growth, although the share little seed weight but the following comments are very important and is important because conditions there should not ever come to be that short. The period is very importance because the event is important that both are involved in determining final yield.

A: The most productive endosperm cell occur in this period of endosperm cell or a potential future target is considered, short of this period due to any stress, disease, dehydration and heat naturally difficult endosperm cell and production will be . Many experiments show that very close and positive correlation between endosperm cell number and grain yield (seed weight) to have shown (10, 13).

B: second place on the course (log) hormone cytokine seed gathering is growing which should reach to a certain period of rapid growth to begin, naturally short period to log accumulation means less material is cytokine hormone, a lack start of rapid growth in the will or that if Re rapid growth period starts will peak very low. Two to three weeks after the flowering period starts, you should log the special care payment (10, 13).

Density in this direction is important. Period of rapid growth, sometimes more than 90 percent of grain weight in a relatively short time is accumulated, this period is called the effective filling period. Density of 25 plants per square meter was the highest value, i.e. the density of EFP effective filling period nurse longer enjoyed the process because of the density due to competition between plant dry matter accumulation and grain slowly during longer made and therefore Dry matter accumulation in grain yield, which lasted longer this density also increased the contrary the density 75 plants m EFP was the lowest effective grain filling period, i.e. the density, the density of 25 plants per square meter is much less and therefore its performance is decreased. ILC482 figure among cultivars and cultivars with highest EFP Hashem was lowest in addition to general environmental effects of effective grain filling period, species and significant effect on the effective period of grain filling process results in grain growth densities showed that at the end of linear growth of density 25 and 75 plants per square meter, respectively the highest and lowest seed weight were. Results of grain growth figures show that at the end of linear growth figure ILC482 highest final grain weight and the lowest figure Hashem final grain weight was included Effective grain filling period between 21.92 and 26.07 figures fluctuate day was..

Most Effective grain filling period the figure for ILC482 approximately 26 days and the lowest effective grain filling period the figure for Hashem was approximately 22 days. Minimum and maximum effective rate of grain filling, respectively, and Hashem ILC482 genotype was observed.

Reference

1- Dutta, R.K. & B.P. Lahiri.1998. Growth and yield of Lentil in relation to population pressure. Lens news letter, 25:1-2, 27-29.
2- Fallah. Seif l ... 2001, studying the growth yield and yield components of chickpea crop cultivars in different densities and under two moisture levels in Khorram Abad, MA thesis, Isfahan University of Agriculture.
3- Khajehpour. M., 1996, Principles and Fundamentals of Agriculture, Isfahan University Publishing Unit.
4- Tlyy, AS. Vk, Syadyan 1999, to determine the effect of supplemental irrigation and food needs in chickpea cultivation, Journal of Agronomic Sciences. Volume II Issue 3.
5- Majnon Hosseini, N., Mohammad, K. Pvsttyny, H.. Zynany convent, 2002. Effect of plant density on agronomic traits and the percentage of leaf chlorophyll content in the remobilization of stem white pea varieties. Journal of Agricultural Science, Volume 34, Number 4.
6- Mckenzie,B.A., and G.D. Hill. 1995. Growth and yield of two chickpea (cicer arietinum L.) Varieties in cant erbury . newziland journal of crop and horticultural science, V.L. 25:467- 474 .
7- Modhan, M. M., S. L. Narayanan and S.M. Ibrahim.2000.chlorophyll stability indexes (CSL): its impacts on salt tolerance in rice. International Rice Res.Instiute. Notes: 25.2:38-40.
8- Mitsuru,O.S,T,K.shinw no, T.D.Toshiak.1991.Redistribution of carbon and nitrogen compounds from the shoot to the harvesting organs during inaturation in field crops.soil sci.Plant nutr. 37(1):117-128.
9- Romana, Alicante and colleagues (1998) spring-sown chick pea
10- Saxena N.P.and A.K. Sheldrake. 1980. Effect of pod exposure on the yield of chick pea. fild crop Res.(z)PP:189-191.
11- Thompson, seed rate, 35:552-501.
12- P.R.andW.D.Martin.1995.A.chickpea cultivars population row space study in southen Queensland.Proceeding of Agron.confer.wagga.
13- Tuba Bicer, B, A. Narin kalender and Do.An.Akar.2004.the effect of irrigation on spring-sown chick pea journal of agronomy Asian network for scientific information.(3):154-158.
14- Fayaz Vayshya and judge Qazi.1992.chlorophyll content in chick pea as in fluenced by seed rate and week. Mangment practices .Intern. Chickpea newsle tters.26:26-27.
15- Watt,j.and R.K.singh.1992.Research of lute sown lentil (lens culinaris) to seed rate,row spacing and phosphorus levels. Indian journal of agronomy, 37:592-592.

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