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Study on effect of planting date and plant density on yield and yield components in irrigated pea cv. Azad in Kerman, Iran

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Abstract

In order to determine effects of planting date and plant density on yield and yield components of irrigated common Pea, cultivar Azad in Kerman city, this experiment was conducted in Kerman Agricultural and Natural Resources Research farm, in 2011-2012. Three planting dates (Feb. 15, Dec. 27, Jan. 6) and 3 plant densities (22, 33, 66 (plants/m^2)) as factorial plots, were studied using RCBD. Results show that delaying in planting date decreased number of pods per plant, number of seeds per pod, and seed yield, significantly. Increasing plant density decreased number of pods per plant, number of seeds per pod but increased seed yield, significantly. The highest yield (2785.6 (kg/ha)) was harvested in first planting date and 66 plants per square meter. It seems that delay in planting decreased growth period and consequently decreased the stored materials in Pea plant and in the other hand coincided reproductive phase with warmth of spring season that decreased flower fertilization and thus increased pod hollowness and decreased seed yield. Increase in plant density decreased yield components but increased seed yield due to more plants per square meter. Increase in seed yield due to increase in plant density is limited, because increase in plant density more than 66 (plant/m^2) increases inner and outer plant competition that would results in less yield.

Keywords: pea, planting date, plant density, yield, Kerman.

Introduction

Cereals are main component of many world poor people's food, because the mixture of their good protein with grains that supply a valuable mixture for their life. In world poor and populated countries, such as India with 11.7 (kg cereals per capita), cereals are bigger proportion of people food than other countries. Cereals consumption in Iran is 4.8 kg per capita that is lesser than world mean of 6.1 kg per capita (Parsa and Baqeri, 2008).

Yadav et al (1994) and Kumar (2001) reported that number of pods per plant, number of seeds per pod weight of 100 seeds of soy bean decreased with delay in planting. Benjamin et al. (2006) showed that optimum planting date is very valuable for plants such as common pea, because they are cultivated in dry regions based on stored water in soil and face hot weather during growth season. Reygan et al. (2003) suggested 20-45 plants per square meter as optimum plant density. Baquet (1990) reported that with increase in plant density weight of single seed of soy been decreased.

Fallah (2000) reported that in common pea plant, increase in plant density decreases weight of single seed. Baqeri et al. (2000) reported decrease in yield of non-irrigated common pea due to high plant density in north of Khorasan. Fathi (2010) in a research to study effect of plant density on yield and yield components of chickling

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vetch in Khoozestan reported that with increase in plant density, number of pods per plants decreased so that most pods per plant was obtained with 8 plants per square meter and the least pods by 20 plants per square meter.

Human being needs plant proteins, thus it is necessary to know and solve the problems of their production. Regarding low water need of common pea and its ability to tolerate water stress and its high protein content, it probably can take a special place in Kerman agricultural system as a strategic crop.

Materials and Methods

This experiment is done in research farm of Kerman Agricultural Research Center, in 2012. 3 planting dates (Bahman 27, Esfand 7, Esfand 17 (Feb, 15; Dec, 27; Jan. 6)) and 3 plant densities (22, 33, 66 (plants/m2)) as factorial plots, were studied using RCBD with 3 replications. Soil sampling was done from depth of 0-40 (cm) from various random points and samples were sent to Soil Lab to determine soil physical and chemical properties. Each plots was 15.60 square meter (6*2.60 m) and planting rows were 30 (cm) apart.

Seeds were put in narrow grooves and covered by hand rake, and then irrigated. Seed yield, weight of seeds per plant, number of pods per plant, number of seeds per pods and weight of 100 seeds were measured. Data were statistically analyzed by SAS software and means were statistically compared by Duncan multi range test (α=5%).

Results and discussion

Seed yield

ANOVA showed significant difference (α=1%) among planting dates in their seed yield. Mean comparison showed that the highest yield (2450 kg/ha) obtained from Bahman 27 planting date. The least yield (1886 kg/ha) was obtained from third planting date (Esfand 17). Musavii and Pezeshkpur (2006), Rezvanimoghadam and Sadeghisamarjani (2008) and Nezami and Bagheri (2005) reported that causes of decrease in seed yield are: delayed planting, low plant high, decrease in number of pod producing nods, decrease in growth period, and decrease in stored dry matters. In this experiment, it seems that decrease in seed yield by delay in planting was due to all these mentioned points.

ANOVA showed that plant density affected seed yield significantly (α=1%). The highest yield (2538 kg/ha) was measured in plant density of 66 (plants/m^2). The least yield obtained from plant density of 22 (plants/m^2) by 1737 (kg/ha). Interaction of planting date and plant density had statistically significant (α=1%) effect on seed yield so that the highest yield (2786 kg/ha) was obtained from plant density of 66 (plants/m^2) and first planting date (Bahman 27). The least seeds (1458 kg/ha) were yielded by plant density of 22 (plants/m^2) planted in Esfand 17.

Weight of seeds per plant

ANOVA showed significant difference among planting dates in weight of seeds per plant (α=1%). Mean comparison showed that the most seeds per plant (6.96 gr) were produced in first planting date (Bahman, 17) and the least (5.23 gr) was produced by third planting date (Esfand 17). This finding is the same as findings of Singh et al. (1997) that reported that sooner planting date increases the plant growth period and thus increases total biomass and as a result seeds weight per plant.

ANOVA showed that effect of plant density on weigh of seeds per plant was significant (α=1%). The most seeds mean per plant (7.82 gr) and the least (3.80 gr) were produced in plant

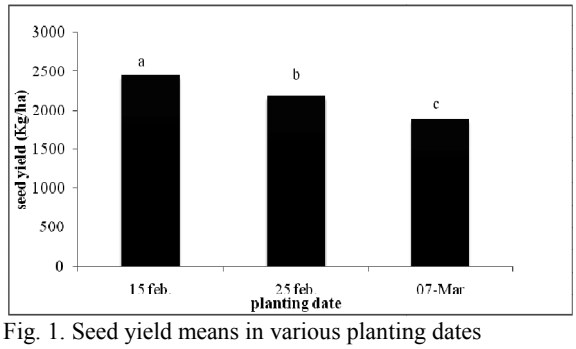

Fig. 1. Seed yield means in various planting dates

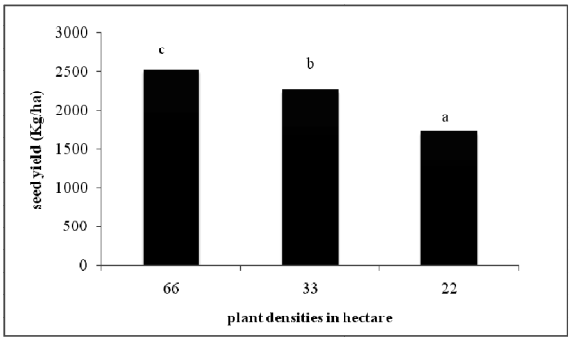

Fig. 2. Seed yield means in various plant densities

Table 1. Mean of Means of Squares (MS) of studied traits in common pea plants in various planting dates and plant densities

Variation source	df	Seed yield	Seed weight/plant	Pods/plant	Seeds/pod	100-seed weight
Replication	2	1118	0.02	0.38	0.001	0.09
Planting date	2	755296**	6.88**	33.74**	0.02**	4.02**
Plant density	4	1506381**	39.50**	98.27**	0.17**	54.24**
Planting date × plant desnity	16	18470**	0.67**	0.19ns	0.001ns	0.16ns
Error		2428	0.02	0.61	0.0001	0.32

*, **, ns with significant (α=5%) and very significant (α=1%) difference and non significant difference, respectively.

Table 2. Mean comparison among various planting dates in common Pea plant.

Planting date	Seed yield (kg/ha)	Seed weight/plant (g)	Pods/plant	Seeds/pod	100-seed weight (g)
15 Feb.	2450 a	6.69 a	27.98 a	0.78 a	30.61 a
25 Feb.	2219 b	6.28 b	27.20 b	0.74 b	30.23 b
7 March	1886 c	5.23 c	24.31 c	0.68 c	29.31 c

Means with same alphabet are not significantly different, according to Duncan multi range test (α=1%)

densities of 22 and 66 (plants/m^2), respectively.

Interaction of planting density and planting date had significant effect on weight of seeds per plant (α=1%) so that the most seeds (8.97 gr) was produced in first plant density (22 plants/m2) planted in first planting date (Bahman 27). The least seeds (3.47 gr) obtained from plant density of 66 (plants/m^2) planted in Esfand 17.

Number of pods per plant

Results of ANOVA revealed a very significant effect of planting date on number pods per plant (α=1%). Mean comparison showed that Bahman 27 planting date with men of 27/98 had the most pods per plant and the least (24.31) was observed in third (Esfand 17) planting date.

Rezvanimoghadam and Sadeghsamarjani (2008), reported that because of long growth period in autumn planting more branches were produced in each plant and as reproductive phase elongated more pods produced per branch. The same results observed in this experiment.

Musavi and Pezeshkpur (2006) and Ortega et al. (1996) also reported that with delay in planting number of pods per plant decreases. Mean comparison showed significant effect of plant density on number of pods per plant (α=1%). The longest internodes was observed in plant density of 22 plants per square meter with mean of 28.91. The shortest internodes (22.73) was measured in density of 66 plants per square meter.

Effect of interaction of planting date and plant density was not significant that shows independent effect of treatments on this attribute.

Number of seeds per pod

ANOVA showed a significant difference among planting dates in their mean seeds per pod (α=1%). The most (0.78) and the least (0.68) seeds were observed in first (Bahman 27) and third (Esfand 17) planting dates, respectively.

Mean comparison showed significant difference among various plant densities (α=1%). The most mean of seeds per pod was observed in density of 22 plants per square meter, by 0.83 seeds. The least mean of seeds (0.58) was observed in density of 66 plants per square meter. Effect of their Interaction was not significant that proves independent effects of treatments on number of seeds per pod.

100-seed weight

ANOVA showed a significant difference among planting dates in weight of 100 seeds (α=1%). The heaviest 100 seeds (30.61 gr) were harvested from first planting date (Bahman 27) and the lightest one (29.31 gr) was observed in third planting date (Esfand 17).

The reasons mentioned in topics of weight of seeds per plants are applied here too. Mean comparison of the effect of plant density on weight of 100 seeds revealed significant difference among various densities (α=1%). The highest weight of 100 seeds (32.13 gr) was observed in density of 22 plants per square meter. The least one with 27.34 (gr) was observed in density of 66 plants per square meter. Effect of their interaction was not significant, that proves independent effects of treatments on the weight on 100 seeds.

Table 3. Mean comparison among various plant densities in common Pea plants

Plant density	Seed yield (kg/ha)	Seed weight/plant (g)	Pods/plant	Seeds/pod	100-seed weight (g)
66	2538[a]	3.80 [c]	22.73 [c]	0.58 [c]	27.3 [c]
33	2279 [b]	6.85 [b]	27.85 [b]	0.79 [b]	30.67 [b]
22	1737 [c]	7.82 [a]	28.91 [a]	0.83 [a]	32.13 [a]

Means with same alphabet are not significantly different, according to Duncan multi range test (α=1%)

Table 4. Mean comparison of interaction of planting date and plant density on measured attributes

Planting date	Plant density	Seed yield (kg/ha)	Seed weight/plant (g)
15 Feb	66	2786 a	4.180 f
	33	2574 b	7.750 b
	22	1992 d	8.970 a
25 Feb	66	2515 b	3.770 g
	33	2380 c	7.140 c
	22	1761 f	7.930 b
7 March	66	2315 c	3.470 h
	33	1884 e	5.650 e
	22	1458 g	6.570 d

Means with same alphabet are not significantly different, according to Duncan multi range test (α=1%)

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