Plantation Date and Bush Density Effect on Crop Yield in Three Promising Bean Lines

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ABSTRACT

Background: This study was conducted according to complete accidental blocks plan with arrangement of double-chopped plots in four replicates in Borujerd agricultural research station, Iran. Objective: In this study, three factors of plantation date in three levels Ordibehesht 23, Khordad 7 and Khordad 22 as the main factor and advanced lines of white been named WA-8563-1, CENIII WAF2/OAC-41118, and CENIII WAF2/OAC-41110 in three levels and bush density in three levels of 300000, 400000 and 500000 bush in hectare constituted the first and second minor factors, respectively. Every experimental plot included four plantation lines with 6 meters in length and 50 cm distance between lines. During maintenance stages, in addition to supervising the treatments, bushes conditions regarding growth, flowering time, sheath, formation time and other agricultural features were defined. Results: after harvest, sheath number in bush, results achieved from means comparison demonstrated that the most yields was related to the plantation date on Khordad 7th with 4923 kg/ha and the line CENIII WAF2/ OAC-41110 with 5082 kg/ha and bush density of 500000 bush hectare with 4938 kg/ha.

INTRODUCTION

By 2025, the population of the world will grow from 7–8 milliard. 90% of this growth will happen in developing countries. Noticing this growth, providing human foods through increasing the operation seems an essential task (Entesari et al., 2007). Grains after cereals are considered as the second food recourse for humans. The amounts of the protein in the grains are 10 to 26 times more than glandular plants like potatoes, and used in most of the foods (Mohammadi, 2006). Leguminous are farmed all over the world and their agricultural species are adapted to different weather conditions like mild, tropical, humid and dry. The ripe and dry seeds of grains have high nutritional value and they are perceivable, and play an important role in many people’s diet in the world. Leguminous containing 18-32% proteins are the biggest nutritional resource after the cereals. So 66% of the vegetarian protein is provided by the leguminous (Glas and Hassel, 1988). Regarding nitrate fixation ability in these plants, on the other hand, placing them alternatively helps in agricultural systems durability. Among cereals; bean, is of special importance. The most important been producers in Asia include China, Iran, Turkey, and Japan (Anuadurai and Palaniappan, 1994, Richardson and Croughan, 1989; Singh and Ksharma, 1988).

In the experiment, the results imply to non-significance of the lines regarding a hundred-seed weight, shrub number in bush, seed number in shrub, bush height and seed yield. The sheath number in bush reduced with increase in bush density and this reduction was significant. With increase in bush density, seed yield also increased and the main reason for increase in seed yield was increase in bush number and ultimately, increase in sheath number in hectare (Dimova and Svetleva, 1993; White et al., 1992). In the other study the factor plantation date with four levels as major treatment (Ordibehesht 8, 18, 28 and Khordad 8) and minor treatment with three densities of bush on row (in three levels of 10, 20 and 30 centimeters) were examined. The greatest seed yield was achieved on Ordibehesht eight with 10 cm bush distance, in the amount of 3448/1 kg/ha (Westerman and Crothers, 1977).

With respect to great importance of this subject, the most important goals of the study consist of examining plantation date, bush density and line effect on agricultural features and the yield of three bean advanced lines, examining reciprocal effects of the factor plantation date, bush density and line on agricultural characteristics and the yield of three white bean new lines and defining the most suitable date and plantation density of three white bean advanced lines.
Methodology:
This research was conducted in Broujerd agricultural research station in southeastern Broujerd, Iran. The height above sea of experiment location was about 1497m with average annual rainfall of 459.4 mm, the maximum and minimum temperature of 40.5 and -24°C, respectively (on average 21.5°C); maximum and minimum relative humidity of 58% and 21.5%, respectively, freezing period of 76 days and dryness period of 160 days and average sunshine hours of 8 hours, total annual evaporation of 2012 mm. This experiment was conducted according to complete accidental blocks plan with arrangement of double-chopped plots in four replicates for two years. The major levels including plantation date in three levels (A1=Ordibehesht 23, A2= Khordad 7, and A3= Khordad 22) as major factor, advanced lines of white bean in three levels (B1=WA-8563-1, B2=CEN III WAF2/OAC-41118, and B3= WA-8563-1, B2= CEN III WAF2/OAC-41118, and B3= CEN III WAF2/OAC-41110) as the first minor factor and bush density in three levels of C1= 300000, C2= 400000, and C3= 500000 bush / ha as the second minor factor were considered. Rows distance was 50cm and bushes distance on row were 6.6, 5 and 4cm, respectively. Every experimental plot included four plantation lines with 6m in length and interlines distance of 50cm, the treatments were planted in a land having been plowed in early spring. Based on soil test, the amounts of organic carbon and absorbable phosphorous and potassium were 1.01 %, 6.3 ppm and 230 ppm, respectively, that the required amounts of fertilizer NPK (50 kg urea, 100 kg superphosphate, and 100 kg sulfate potassium) were added to soil and then two disks vertical on each other were mixed with soil. The seeds were planted based on respective density and plantation date (up to three times of respective density amount) by worker. At the time of formation of the third leaflets, the bushes, according to respective density, were become sparse with distances of 5.6, 6, and 4 centimeters. Fighting with weeds and pests were performed every two years and in several stages.

During the two years of manipulating the experiment of agricultural features of plots such as the times of flowering (when 50 percent of bushes flowered), sheath filling (when 50 percent of bushes being to make sheath), physiological ripeness, complete ripeness in maintenance stage were defined and noted. At the time of harvest also, by selecting one length meter from every two lines in the middle of each treatment, to bushes were harvested and bush height, sheath number in bush, seed number in bush, bush’s seed weight and a hundred seed weight were measured and recorded. In every two years after complete ripeness of bushes, the whole crops of each plot was harvested and seed and hay were separated from each other and after weighting its amount was converted into yield in hectare.

After separating seed from hay the produced seeds were weighed in order to define seed yield. Also the seeds of harvested bushes of each treatment were weighted in order to define bush yield and their mean was recorded as bush yield. From each treatment, a hundred seeds were randomly separated by seed-counter machine, weighted and recorded. For two-year statistical analysis and variance analysis of treatment’s means comparison, SAS 9.1.

RESULTS AND DISCUSSION
The results of analysis of variance and means comparison test showed that the influence of plantation date on of Ordibehesht 23, appeared 9.5 days, on Khordad 7, 6 days, and on Khordad 22, 4 days after plantation (Table 1). In discussion of treatments reciprocal effects, according to table (1), plantation date of Ordibehesht 23 × line × density with duration of 9.5 days relative to treatment of plantation date on Khordad 7 × line × density with duration of 6 days and treatment of plantation date on Khordad 22 × line × density with duration of four days had a significant difference. Based on analysis of variance and means comparison test, the effect of plantation date on flowering is significant (0.01), so that at plantation date of Ordibehesht 23, flowering appeared 54 days (two-year mean), on Khordad 7, 48.5 days and on Khordad 22, 45.5 days after plantation. Line and bush density in this experiment were not of a significant effect on flower appearance. In discussion of treatments’ reciprocal influences, according to table, the treatment of plantation date on Ordibehesht 23 × line × density of appearance with duration of 9.5 days relative to treatment of plantation date on Khordad 7 × line × density with duration of 6 days and treatment of plantation date on Khordad 23 × line × density with duration of 4 days had a significant difference.

According to variance analysis table (table 1) and means comparison table influence of plantation date on flowering time is significant (0.01) so that at plantation date of Ordibehesht 23, flowering appeared 54 days, on Khordad 7, 48.5 days and on Khordad 22, 45.5 days after plantation. Line and bush density in this experiment did not have a significant effect on flower appearance. In discussion of treatments’ reciprocal effects, the treatment relating to plantation date of Ordibehesht 23 × line × density with duration of 54 days than the treatment for plantation data on Khordad 7 × line × density with duration of 48 days and treatment of plantation data on Khordad 22 × line × density with duration of 45 days was of significant different. Also, the effect of plantation date on Sheath formation (0.01) and its filling (0.05) was significant, so that at plantation date of Ordibehesht 23, sheath formation came to sheath formation stage 63 days, on Khordad 7, 55.75 days, and on Khordad 22, 54.08 days after treatment plantation. Also plantation date of Ordibehesht 23, sheath filling came to
sheath-filling stage, 89.5 days, on Khordad 7, 78.33 days and on Khordad 22, 73.92 days after plantation. Line type was also of a significant influence (0.05) on time of sheath formation.

The results of variance analysis (table 1) and means comparison test showed that the effect of plantation date on the time of physiological ripeness and complete ripeness of the crop is significant (0.01) so that at plantation date of Ordibehesht 23, physiological ripeness and complete ripeness came to this stage with 101 and 108.67 days, on Khordad 7, with 104.17 and 107.83 and on Khordad 22, with 102.17 and 106.67 days after treatment plantation.

### Table 1: The variance analysis (ANOVA) of different treatments on characteristics.

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<th>Plantation date</th>
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The line factor also had a significant effect (0.01) on the time of physiological ripeness and complete ripeness so that the lines CEN III WAF2 / OAC-41110 and CEN III WAF2 / OAC-41118 had a significant difference with 103.17 and 108.17 days respectively, after plantation with the line WA-8563-1 with 101 and 106.83 days after plantation. The density factor was not of a significant effect on the time of physiological ripeness and complete ripeness of the crop. Examination of reciprocal effect of treatments on sheath formation and its filling showed that the treatment of plantation date on Ordibehesht 23$\times$ line $\times$ density with duration of 99 days for physiologic ripeness and 109 days for complete ripeness than treatments of plantation date on Khordad 7$\times$ line $\times$ density with duration of 103.5 days for physiological ripeness and 106.5 days for complete ripeness and the treatment of plantation date on Khordad 22$\times$ line $\times$ density with duration of 103 days for physiological ripeness and 107.5 days for complete ripeness had a significant difference.

### REFERENCES


