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ORIGINAL ARTICLES

Seed Rates Effects on Morphophysiological Traits of Hulless Barley Lines

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ABSTRACT

The objective of this study was to determine the effects of seeding rates (400, 450 and 500 seed/m^{2}) on morphophysiological traits of six hulless, promissing new lines named EHBYT 81-1, 2, 5, 11 and line number 18. a strip plot experimental design in base of randomaized block was set up in three replications at karaj Seed and Plant Improvement Institute, during 2004- 2006. The main- plots were allocated to the new six barley lines and sub- plots were three levels of seeding rates mentioned above.Combined analysis of variance for grain yield and yield components showed, that diference due to grain yield was significant ($P<0.05$), however, analysis of variance for yield cmponent showed that differences due to number of fertile spikes/m^2 were significant ($P<0.05$). The highest grain yield was obtained (6.914 t/ha) from EHBYT-M 81-11 a promissing new line. It is concluded that appliction of 400 seeds/m^2 is a suitable seeding rate for obtaining high grain yield of hulless barley. Also combined analysis of variance (two years) showed that Between the lines of quality traits studied The protein content and Amylose content of grains was observed statistically significant difference.

Key words: Genotype, Density, Yield and Yield components, Hulless Barley.

Introduction

Demand for high-energy, low-fiber-grain by the vertically integrated swine and poultry industries and the availability of brewers' and distillers' grains for the beef and dairy industries have greatly reduced the market for traditional barley (Tiwari U., *et al* 2008). In an effort to recapture a share of this feed market, there has been an emphasis placed on the development of the more energy-dense hulless type of barley. Meanwhile, increased interest in the use of hulless barley cultivars in the manufacturing of food and fuel products has accentuated the desire to develop winter hulless barley varieties for both domestic and foreign markets. Additionally, barley grain contains health-related compounds similar to those found in oats, adding to its appeal in the health-food sector (Varshney., *et al* 2008). Due to the increasing population Source of protein for human nutrition and the annual import large quantities of corn, hulless barley crops that can be used in poultry diets and substitute wheat or corn to be imported, And with the increased production of cheaper white meat, to reduce consumption of wheat in the poultry industry(Binam.,2000 ; Wallwork *et al*.,1998). Studies on hulless barley shows that hulless barley varieties of broom that grain yield between 5 to 5.5 tons with 14 to 16 percent protein. And the Lysine rate of 4 to 5 percent of wheat grain and celebrate their culture for late planting, areas with limited water, dryland areas, saline and alkaline soils and wet river can be explained and it can be used to enhance the nutritional value of with wheat bread (Hijikuro and Amdo., 1989). Studies have shown that mixing at least 25% of barley flour in bread can reduce bottlenecks and shortages. Endey *et al*. (1992) Two -row barley, hulless varieties of food composition without the protein, starch, amino acids and fiber studied and reported that the starch content of the hulless barley above it and is covered in hard spring wheat.

Hijikuro and Amdo.,(1989) effect of Cellulose supplementation to improve nutritional value of hull-less specify m without the normal protein, high in protein and very high protein As a basal diet of laying hens studied And concluded,that cellulase protein supplements in effect specify m high with hulless the hens on a diet with no more than specify m hulless protein is normal. Wallwork *et al*., (1998) Reported that high temperature *(*35 ° C) The grain filling period, yield and grain quality will reduce. They also reported that in all varieties The detrimental effect of high temperature, reduction in starch accumulation caused the greatest reduction in seed weight. Yousefi *et al*. (2001,2002), In experiments comparing the performance of promising genotypes of temperate regions (EHBYTM-81), Were studied, 20 hulless barley genotypes, promising in a randomized complete block design the analysis consists of three stations and Karaj, Varamin and Zarghan six genotypes genotypes with the numbers 1, 2, 5, 7, 11 and 18, respectively, with an average yield of 5635, 5524, 4936, 5625 5664 and 4763 (kg\ha) As for the evaluation and selection of superior genotypes were selected to the field.

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Generally, the density of hulless barley genotypes with no little has been done in Iran. This study investigated the effect Morphophysiological of different genotypes without hulless barley looks promising.

Materials and Methods

Study using statistical design of split plots in a randomized complete block And a total of 18 treatments and three replications in Karaj region of Iran, With 51 degrees east longitude and 35 degrees north latitude and altitude of 1321 meters above sea level average annual rainfall of 250 mm was performed. Operating a hulless barley genotypes of six genotypes : EHBYTM81-1, 2, 5, 7, 11, 18 The main plot factor and seed rate were on three levels: 400, 450 and 500 seeds per square meter plots. Each experimental unit with a 6 m in length and width of 2.5 meters, which includes four stacks according to the method of planting seeds in each stack and the fourth line of the atmospheric general planting and sowing in each plot there were 16 lines. With regard to 0.5 m from the beginning and end of each experimental unit as the margin, The remaining five meters from each experimental plot was allocated to the final grain yield. Recommended amount of fertilizer based on soil test and plant nutrition research Determined before planting and 150 kg of ammonium phosphate, potassium sulfate(100 kg) and 200 kg of urea[$Co(NH_2)_2$]. Half of the other half as a fertilizer as basal fertilizer was applied to the roads. In the first decade of November and harvested in the first planting date was July. Irrigation based on plant needs, and five times, including once in the fall and spring were done four times. After physiological maturity of seeds (1) m^2 from each treatment were harvested, and to evaluate the performance of components and final biomass were sent to the laboratory.

After harvest was added, each plot of 600 grams of sample preparation and chemistry laboratory for measurement of Amylose content of cereal grain starch and protein. the starch samples were prepared in the laboratory should be no way to extract starch from hulless barley is as follows : From each sample, 2 to 3 seeds in ammonium 0.2 M and placed for 24 hours and then we replaced the ammonium 0.5 ml salt 0.5 mole and then smooth and then centrifuged.4 M NaCl was added, and then we centrifuged. and the solution is discarded and added to distilled water after vertex and centrifugation and on there, layer colored supernatant. Finally, Stone added, vertex and centrifugation and the starch to make a desiccators. Obtained with the use of starch and starch Amylose content, as we define :

To 5 mg of starch One mg of ethanol and 2.7 ml of normal salt added, and we move then, Baker put in a sand bath until the starch gelatin, then, using the solution volume to 25 ml of distilled water and delivered them to separate from each sample, 2 replication of 2.5 ml. and we added 2 ml of citric acid 0.3 normal, and 1 ml of freshly prepared Aidan, the volume of each sample with 20 ml of distilled water to the plant and put in refrigerator and after 20 minutes of the vortex and the wavelength of 620 nm spectrophotometer to read the amount of starch Amylose content. After the measurement of Amylose content of starch samples, the results collected, analysis of variance and mean comparison was performed.Moreover, in the laboratory using (Inframatic 8600) Moisture content and grain protein were measured directly. These devices can be added that in contrast to previous approaches this device, the protein directly (without grinding) that measures. This mechanism, based on the sample and the reflected radiation beam takes place. After measuring the protein content of samples, the results collected, analysis of variance and mean comparison was performed.

Results:

Analysis of variance in Table (1) show that the combined effect of year on grain protein percentage is statistically significant. The results showed that the protein content of the lines indicate statistically significant differences with each other the method according to Duncan's mean number of lines with the highest protein yield was 13.40 and alone A Class were analyzed. And the line number 4, 5, 2, 3 and 6, respectively, with grain protein percentage of 13.36, 13.24, 12.99 12.91 and 12.90 were used in subsequent classes. The results of the effect of density on grain protein percentage was not statistically significant but The study of means comparison found that density of 450 seeds per square meter, with 13.28 % protein had the highest percentage. Table (1) shows that the percentage of grain protein concentration × line interaction was not significant but, two lines of numbers with density of 450 seeds per square meter grain protein percentage was the highest rate of 13.51 percent. The results showed that the effect on the amylose content of starch grains is statistically significant, Amylose content and starch grain hulless barley lines were highly significant in terms of statistical, So line number five with a 25.36 % Amylose starch grains had the highest percentage is in between the lines and was alone in the class A. The treatment effect of density on the Amylose content of starch grain hulless barley line had a statistically significant, So the density of 500 seeds per square meter with a 93/23 % has the highest Amylose starch grain. The effect of density on the line in Amylose starch grains was significantly So line number five seed density in 500 m2 the highest, and line number three, with a density of 400 seeds per square meter with a 87/18 %, Allocated to the lowest Amylose content of starch.

Results of Combined analysis of variance for two years on each of the traits Growing season in 2005 and 2006 in Table (1) are shown. As can be seen from some of the components of seed yield between genotypes under investigation, observed Significant difference in the level of 5 % and 1 %, The average grain yield and yield components in the treatment of study In two years, experiment is the mean of three replications are shown in Table (2).The results showed that the density of statistically significant effects was not significant on grain yield but the effect of genotype on grain yield was significant (P<0.05). And the mean comparison using Duncan number five genotypes tested,with a mean grain yield of 6.914 (Ton\ha) in two years the highest yield among the genotypes were assigned to the test and genotype number two experiments with performance equivalent to 5.876 (Ton\ha) had the lowest grain yield. Density effects on grain yield of genotypes in this experiment were not statistically significant but In comparison of mains using the Duncan test a density functional treatment, ie 400 seeds per square meter, equivalent to 6.402 tons per hectare, The highest yield was 2% higher than the density was 500 seeds per hectare. The effect of genotypes and the densities on the biological yield was not statistically significant, but In comparison of mains number of genotypes of five experiments with biological yield 20.757(Ton\ha) The highest was biological yield number six was 13 % higher than that of genotype.

Another Yield of the components in this experiment were the number of fertile spikes was per unit area. The results showed that the comparison of mains The genotypes of the fertile spike in the number of five experiments with 999 square meters, the highest number of spikes per unit area in between is a genotype. Density effect of the spike was not significant statistically the comparison showed that the mean density of 400 seeds per m2 with 778 spike in m2, the highest, and a density of 450 grains white 730 spike in (m2), Fertile spikes per square meter, the lowest density was in between treatments.

The results of the harvest index showed a statistically significant interaction between age and density of the genotype, the genotype and the interaction was not statistically significant. Mean of comparison harvest index genotypes revealed that genotype 6 with 35 % highest and Genotypes number two and four experiments with 31 % allocated to the lowest harvest index (Table 2).

Table 1: Analysis of variance experimental compound traits in two years(2004-2006).

S.O.V	D.F	Protein (%)	Amylose (%)	Grain Yield (ton\ha)	Biological yield (ton\ha)	N. Spike in m^2	HI (%)
Year	1	*	**	ns	ns	**	ns
Replication	4	*	*	ns	*	ns	ns
genotype	5	*	**	*	ns	**	ns
genotype*Year	5	**	ns	ns	ns	*	**
Error(a)	20	0.375	9.460	1.725	19.46	15286	0.003
Density	2	ns	*	ns	ns	ns	ns
Density* genotype	10	ns	**	ns	ns	ns	ns
Density*Year	2	ns	*	ns	ns	ns	ns
Density* genotype*Year	10	ns	**	ns	ns	ns	ns
Error(b)	48	0.306	6.74^{ns}	0.350	5.57	23114	0.0018
CV %		4.21	11.27	9.33	11.93	20.12	13.19

ns, * and **, respectively, indicating non-significant, significant at 5% and 1%

Table 2: Average grain yield and grain yield components in the experimental treatments under study in two years (2004-2006).

Treatment	Protein (%)	Amylose (%)	Grain Yield (ton\ha)	Biological yield (ton\ha)	N. Spike in m^2	HI (%)
Genotype						
EHBYTM-81-1	13.40a	23.08bc	6.439ab	20.243a	689bc	0.32a
EHBYTM-81-2	12.99ab	22.00bc	5.876b	19.219a	654c	0.31a
EHBYTM-81-5	12.90b	21.11c	6.096ab	19.889a	745bc	0.32a
EHBYTM-81-7	13.37ab	22.89bc	6.276ab	20.239a	706bc	0.31a
EHBYTM-81-11	13.24ab	25.36a	6.914a	20.757a	999a	0.34a
EHBYTM-81-18	12.90b	23.81ab	6.444ab	18.397a	750b	0.35a
Density (grain in m^2)						
400	12.97a	22.82ab	6.402a	19.769a	778a	0.33a
450	13.28a	22.37b	6.335a	20.028a	730a	0.32a
500	13.14a	23.93a	6.286a	19.575a	763a	0.33a

Means in each column followed by at least one similar letter are not significantly different at the 1% probability level, using Duncan's Multiple Range test.

Discussion:

The results showed that the effect on grain protein percentage is statistically significant (P<0.05) and this shows that the effect of weather conditions is different on different lines protein (%) of hulless barley. Protein content of the lines also showed with each other significant differences of statistically and Line No. 1, won the highest grain protein content. In this study the density effects on grain protein percentage was not statistically

significant. From the above results it can be concluded that the line number 5 (EHBYTM-81-11) having the highest percentage of Amylose starch, can be used in preparing food for long attracted people who are overweight. On the other hand, seeds that have low Amylose content are more Are absorbed faster than they can be used to fast food diets that absorbed energy will be absorbed that one of these is used in feeding livestock and poultry meat. In this regard, the Experiment line 3 (EHBYTM-81-5), With 21.11(%) starch Amylose is suitable for this application.

The results showed that some components of grain yield between genotypes under investigation there are significant differences that reflect the diversity among the genotypes can be evaluated for these traits. and number five genotypes tested, with a mean grain yield of 6.914 (tons\ha) in two years, the highest grain yield among the genotypes studied themselves in the experiments. Density effects on grain yield of genotypes in this experiment is not statistically significant and the costs of seed and lack of significant levels of density effects on grain yield the density of 400 seeds per square meter at the plant of hulless barley is recommended in temperate regions. Study of the number of fertile spikes per unit area in this study showed that the effect of year, genotype and genotype-year interaction terms were statistically significant. The results showed that the trait number of fertile spikes per unit area of different genotypes, the effect of different climatic conditions and number five tested genotypes had the highest number of spikes per unit area is among the genotypes, Most of the reasons being that its performance is compared to other genotypes. The results showed that the correlation between grain yield traits without hulless barley genotypes in this experiment there is a significant positive correlation with biological function (statistically significant). Indicating the direct relationship between photosynthetic organs of plants and is the final production. These results are consistent with the results (Ellis and Kirby., 1980) had announced that they will follow the well performance of the 1000 - grain weight. Overall the results in two years can be concluded that the number five genotypes experimental (EHBYT-M-81-11), Among the genotypes studied, the highest yield. The yield increase the high number of fertile spike and 1000 - grain weight than the other genotypes studied in this experiment. Since the density of the applied treatments (other than minor items) to grain yield and grain yield components without hull-less barley genotypes in this experiment were not statistically significant the density of 400 seeds per square meter, more convenient and economical for hulless barley genotypes experimental, was found suitable.

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