Research Article
www.ekinjournal.com
Ekin
Journal of Crop Breeding and Genetics
6(2):83-90, 2020
Ekin International biannual peer-reviewed journal

Sowing Time, Variety and Seed Fungicide Application Effect on Grain Quality Properties of Bread Wheat

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Citation:
Baser İ., Gider İ., Bilgin O., Balkan A., 2020. Sowing Time, Variety and Seed Fungicide Application Effect on Grain Quality Properties of Bread Wheat. Ekin J. 6(2):83-90, 2020.

Received: 11.01.2020 ***Accepted: 06.05.2020*** ***Published Online: 27.07.2020*** ***Printed: 30.07.2020***

ABSTRACT

In the present study, Esperia, Genesi, Anapo bread wheat varieties (early, middle and late-maturing time, respectively) were used as materials and the seeds of these varieties were treated with 4 different seed fungicides (Prothioconazole + Tebuconazole, Carboxin + Thiram, Prochloraz + Triticonazole and Control) before sowing. After that, these 3 varieties were sown on November 1, November 15 and November 30. The quality characters such as test weight, gluten ratio, gluten index, sedimentation value, sunn pest damage ratio, black point ratio and protein ratio were investigated. When the quality features are analyzed in terms of three different sowing times, the highest quality values are obtained from 2nd sowing time, while the lowest values are obtained from the cultivation on 1st sowing time. Among the wheat varieties, the highest quality values were obtained in the Esperia variety, while the lowest values were the earliest variety Anapo. When the effects of four different seed fungicide applications on the quality characteristics are examined, the highest means were in Carboxin + Thiram and Prochloraz + Tiriticonazole fungicide applications for gluten ratio; were in Carboxin + Thiram, Prothioconazole + Tebuconazole and Prochloraz + Tiriticonazole fungicide applications for gluten index and protein ratio. The most appropriate seed fungicide applications were Carboxin + Thiram and Prothioconazole + Tebuconazole for test weight, black point ratio and sunn pest damage ratio, and the Prob thioconazole + Tebuconazole seed fungicide application for sedimentation value. Higher quality values were obtained in all three seed fungicide applications for all quality characteristics compared to control applications.

Keywords: wheat, sowing time, fungicide, gluten, sedimentation, protein ratio

Introduction

The resistance of living organisms to biotic and abiotic stress factors is closely related to the living creature's genetic structure and the environmental conditions in which they grow. Plants are significantly affected by biotic stress factors. Fungi such as *Fusarium culmorum*, *Fusarium pseudograminearum*, *Gaeumannomyces graminis*, *Bipolaris sorokiniana* and *Rhizoctonia cerealis* cause root and root rot disease in wheat. These fungi that cause disease are of soil origin and can be transported by seed. Numerous studies have been conducted on root and root throat rot and yield loss caused by nematodes in wheat. Studies in Europe, USA, West Asia, North Africa, Australia and Canada show that the yield loss in cereals ranges from 5-50% due to these soil-borne factors (Singh *et al*. 2005; Nicol and Rivoal 2008).

In recent years, a significant increase has been observed in the root and crown rot disease of wheat in the Thrace region. They stated that the decrease in the percentage of disease severity among the cultivars used in the study was highest in Golia cultivar (Köycü and Özer 2014). The genotypic (variety) structure of the plants, the environmental conditions in which the plants are grown, the soil characteristics and the cultural practices applied during the growing process are important in the effectiveness of the plants. According to the studies carried out in the areas infected with the disease in our country, the yield loss is up to 42%

due to root and crown rot disease and 45% due to nematodes (Hekimhan *et al*. 2004; Nicol *et al*. 2005). According to a study, using different types of grain, the yield increase with the use of nematicides ranged from 7 to 89% (Bolat *et al*. 2004). According to the results of the surveys conducted in recent years, *F. culmorum* was found in 14% out of 518 plant samples taken in dry farming areas. The prevalence ratio of *B. sorokiniana* and *F. pseudograminearum* was 10% and 2%, respectively (Bağcı *et al*. 2006). The study was carried out for 2 years to determine the effect of sowing time, ripening time and seed fungicide use on root and crown root damage in bread wheat varieties.

Materials and Methods

The research was carried out according to split-split-plot experimental design in the trial areas of the Department of Field Crops, Faculty of Agriculture, University of Tekirdağ Namık Kemal. Esperia (1), Anapo (2), and Genesi (3) varieties, which are in the early, medium and late maturation groups, respectively, were used as materials in the study. Three wheat varieties were sown at three different times, on November 1 (1st sowing), November 15 (2nd sowing) and November 30 (3rd sowing). The seeds of these varieties were treated with 4 different seed fungicides (Carboxin + Thiram (1), Prothioconazole + Tebuconazole (2), Prochloraz + Tiriticonazole (3) and control (4)). Sowing was done in plots of 6.12 square meters (0.17 m between rows, 6 m in rows) consisting of 6 rows) by sowing machine, and sowing density has been adjusted to 500 plants per square meter. The experiment was carried out in 3 replications. To prevent weed development, broad leaf weed + grass herbicide was applied. No chemical was sprayed against diseases and pests in the trial area. For the necessary measurements and weighing, 10 plants were randomly sampled from each plot at harvest maturity and the plots were harvested by the plot combine harvester. The quality characters such as test weight, gluten ratio, gluten index, sedimentation value, sunn pest damage ratio, black point ratio and protein ratio were investigated. The data obtained in the experiment were analyzed by using the JUMP 5.0 statistical package program, and the differences between the averages obtained were determined by the LSD test.

Results and Discussion

Gluten ratio, gluten index and test weight

Variance analysis was performed for gluten ratio, gluten index and test weight values to determine the effect of different sowing time, variety and different seed fungicide applications on grain quality in bread wheat. According to the results of the analysis of variance, the sowing time, variety and seed fungicide affected gluten ratio and test weight significantly. Studies in Europe, USA, West Asia, North Africa, Australia and Canada showed that the yield loss in grain ranges from 5 to 50% due to root and crown rot disease (Singh *et al*. 2005; Nicol and Rivoal 2008). The effect of fungicide application on seed was found to be statistically significant while the effects of sowing time and variety on the gluten index were non-significant. The mean and significances for gluten ratio, gluten index and test weight are given in Table 1.

The highest gluten ratio is obtained at the latest in sowing time (3rd sowing time) with 30.47%, while the lowest value is obtained in the same statistical group the first and second sowing time. Among the varieties, the highest gluten ratio was found in the Esperia variety, while the lowest was the earliest variety Anapo with 24.25%. According to studies carried out in disease-contaminated areas, product losses occur up to 42% due to root and crown rot disease and up to 45% due to nematodes (Hekimhan *et al*. 2004; Nicol *et al*. 2005). In fungicide applications on seed, the highest gluten ratio was in Carboxin + Thiram and Prochloraz + Tiriticonazole application, the lowest value was obtained in standard plots where no fungicide was applied.

In the case of gluten index, the planting time and differences between cultivars were statistically non-significant. The highest gluten index value was obtained in Prochloraz + Triticonazole, Prothioconazole + Tebuconazole and Carboxin + Thiram fungicide applications. According to a study on different cereal varieties, the increase in yield with the use of nematicides varied between 7 and 89% (Bolat *et al*. 2004).

The 2nd sowing time with 75.92 kg/hl gave the highest test weight value, while the lowest value was at the 3rd sowing time with 72.86 kg/hl. Among varieties, the highest test weight was found for Genesi and Esperia varieties with 75.31 and 74.86 kg/hl, respectively.

The Carboxin + Thiram and Prothioconazole + Tebuconazole fungicide applications on seed, obtained the highest test weight values 74.85 and 74.63 kg/hl, respectively, were the most suitable applications for test weight, while the lowest value of test weight (74.03 kg/hl) was obtained in control. In their study on root and crown rot in wheat, grain yields ($P<0.01$), drug administration ($P<0.003$), disease severity ($P<0.05$), doses used ($P<0.01$) and effects of fungicide on disease severity ($P<0.01$) was found statistically significant. Grain yields were statistically significant in Triticonazole (366-17.7), Difenoconazole (360-15.8), Diniconazole (340-9.3) and Carboxin (338-8.7). The sowing time x variety x seed fungicide interaction means and their significances for gluten ratio and test weight are given in Table 2.

When the cultivation time x cultivar x seed fungicide interaction was examined, gluten ratio varied between 35.33 and 19.20%. The highest gluten ratio was obtained in Prochloraz + Triticonazole fungicide application at the 3rd sowing time of the Genesi variety, followed by Prothioconazole + Tebuconazole and Carboxin + Thiram medication at the 3rd sowing time. The lowest gluten ratio value was obtained in the seed that not fungicide application of the Anapo variety at the 1st sowing time. The highest value in terms of test weight was obtained in the application of Carboxin + Thiram at the 2nd sowing time of Genesi variety with 78.00 kg/hl, followed by the application of Carboxin + Thiram at the second sowing of Esperia with 77.67 kg/hl. The lowest value was in the application of Carboxin + Thiram seed fungicide at the time of the 3rd sowing of Anapo variety with 70.33 kg/hl.

Sedimentation value and Protein ratio

The results of variance analysis of the data showed that sowing time, cultivar and seed fungicide application had a statistically significant effect on the sedimentation value and protein ratio. The fact that *F. culmorum* isolates are frequently obtained in *Fusarium* genus reveals the importance of the Thrace Region (Köycü and Özer 2014). Averages and their significance are given in Table 3.

The highest sedimentation value was found at the time of the 3rd sowing with 47.97 ml, which is a very high value compared to other sowing times. Among the cultivars, the highest sedimentation value was in Genesi and Esperia cultivars with 42.04 and 41.69 ml, respectively, while the lowest was in Anapo cultivars with 31.66 ml. More than 5000 lines were selected by inoculating over 5000 breeding lines under field conditions. More than 50 wheat genotypes have shown resistance to root and root throat (Nicol *et al*. 2005). The highest sedimentation value in seed medicines was 40.85 ml, while Prothioconazole + Tebuconazole was in the drug application, while the lowest was 36.22 ml. High nitrogen doses increase root and root throat disease in wheat (Smiley *et al*. 1996).

In the study, the highest protein ratio was obtained from the 3rd sowing time with 13.73%. Among the varieties, the highest protein ratio was 13.13 and 13.02% for Esperia and Genesi varieties, respectively, while Anapo, the early variety, was the lowest protein ratio with 11.85%. Carboxin + Thiram, Prothioconazole + Tebuconazole and Prochloraz + Tiriticonazole applications seed fungicide applications gave the highest protein ratio values, while the lowest protein rate was obtained in the non-fungicide application. Average values and their significances of sowing time x variety x seed fungicide interaction for sedimentation value and protein ratio are given in Table 4.

It is revealed from Table 4 that the mean sedimentation value of bread wheat varies ranged between 56.33 and 25.00 ml. The highest sedimentation value was obtained with the application of Prothioconazole + Tebuconazole application at the 3rd sowing time of the Genesi variety with 56.33 ml, followed by Carboxin + Thiram, Prochloraz + Tiriticonazole and control at the 3rd sowing time of the Genesi variety. The lowest sedimentation value was obtained from the control application of Anapo variety at the 1st sowing time with 25.00 ml.

In the case of protein ratio, the highest value was obtained in Prochloraz + Triticonazole fungicide application at the time of the 3rd sowing of the Genesi variety with 14.80%, followed by the application of Prothioconazole + Tebuconazole in the 3rd sowing time of the Genesi variety. Spolti *et al*. (2013) investigated the effect of fungicide with Metconazole and Metconazole + Pyraclostrobin in the wheat varieties of 2009 and reported the highest grain yield increase with the application of Metconazole + Pyraclostrobin fungicide mixture.

Black point and Sunn pest damage ratio

The results of variance analysis for black point and sunn pest damage ratio indicate that sowing time and variety effect on the black point was statistically insignificant, while the effect of seed fungicide application was statistically significant. In their study on wheat, they revealed that some fertilizer form and pesticide use can give effective results in reducing root and root rot (Akgül and Erkılıç 2016). The effect of sowing time on sunn pest damage ratio is insignificant, but the effect of cultivar and seed fungicide application is statistically significant. The mean and their significances for black point and sunn pest damage ratio are given in Table 5.

The sowing time and the effect of the variety on black point ratio were statistically insignificant. However, it is seen from Table 5 that the lowest black point ratio is at the time of the 2nd sowing time and the highest is at the 1st sowing time. Among the varieties, Esperia was the lowest lack point ratio. When the seed fungicide is examined, it is understood that the lowest black point values are obtained in

Prothioconazole + Tebuconazole, Carboxin + Thiram and Prochloraz + Tiriticonazole fungicide applications, while the highest rate was obtained from controls.

The highest value for sunn pest damage ratio was determined in the 1st sowing time. As for the varieties, the highest sunn pest damage ratio was in Esperia, while the lowest was Genesi, the latest variety. In the case of seed fungicide application, Carboxin + Thiram drug application was the highest damage, while the lowest value was in non-fungicide ones.

Since the sowing time x variety x seed fungicide interaction for the black point ratio and the sunn pest damage ratio are statistically significant, the averages obtained and their significance is given in Table 6.

As a result of different sowing time and seed fungicide applications, wheat varieties have averages ranging from 3.3-1.00% for black point ratio and varying between 1.0-2.0% for sunn pest damage ratio. The highest black point ratios were obtained in Carboxin + Thiram fungicide application at the 3rd sowing time of Genesi variety with 3.33% and are not applied fungicide (control) at the 1st sowing time of Anapo variety.

However, the lowest value was obtained in none fungicide application (control) at the 3rd sowing time of Anapo variety with 1%. While the sunn pest damage ratio was generally at the level of 1%, the highest ratio was obtained with the application of Carboxin + Thiram fungicide at the 1st sowing time of Esperia cultivar and the 3rd sowing time of the Esperia cultivar in the application of Prothioconazole + Tebuconazole fungicide.

Conclusion

The data showed that sowing time, cultivar and seed pesticide application effects were statistically significant on the quality characteristics in bread wheat. It was understood that there were decreases in quality characteristics in early sowing, and there was an increase in the quality characteristics as the sowing delayed. Among the varieties, while the quality characteristics were lower as expected in the early varieties, the quality characteristics were high in the most recent varieties. It has been determined that seed fungicide application causes significant improvements in all quality features.

Table 1. Average values and significance groups for gluten ratio and test weight.

Gluten ratio (%)									
Sowing time			**Variety**			**Seed fungicide application**			
1	2	3	1	2	3	1	2	3	4
24.67 b	24.28 c	30.47 a	27.89 a	24.25 c	27.28 b	27.70 a	26.37 b	27.37 a	24.44 c
LSD : 0.970			**0.504**			**0.437**			
Gluten index									
Sowing time			**Variety**			**Seed fungicide application**			
1	2	3	1	2	3	1	2	3	4
92.25	93.8	93.33	93.00	93.472	92.912	92.93 ab	93.52 a	94.4 a	91.59 b
						LSD: 1.797			
Test weight (kg/l)									
Sowing time			**Variety**			**Seed fungicide application**			
1	2	3	1	2	3	1	2	3	4
74.53 b	75.92 a	72.86 c	74.86 a	73.14 b	75.31 a	74.63 ab	74.85 a	74.22 bc	74.04 c
LSD : 1.218			**0.712**			**0.528**			

Sowing times : 1.(1 November), 2. (15 November), 3. (30 November); **Varieties :** 1 (Esperia), 2 (Anapo), 3 (Genesi)
Seed fungicides: 1 (Carboxin + Thiram), 2 (Prothioconazole + Tebuconazole), 3 (Prochloraz + Tiriticonazole) and 4 (Control)

Table 2. Average values and significance groups regarding the gluten ratio (%) and test weight (kg/hl) in the sowing time x variety x seed fungicide interaction.

Sowing time x variety x seed fungicide interaction (Gluten ratio)				Sowing time x variety x seed fungicide Interaction (Test weight)			
1*1*1	32.00 cd	2*2*3	21.00 n	1*1*1	72.00 lmn	2*2*3	75.33 efg
1*1*2	29.00 ef	2*2*4	19.67 o	1*1*2	75.00 fgh	2*2*4	73.33 ijk
1*1*3	31.33 d	2*3*1	25.33 i	1*1*3	74.33 ghi	2*3*1	78.00 a
1*1*4	27.67 gh	2*3*2	25.33 i	1*1*4	75.00 fgh	2*3*2	74.00 hij
1*2*1	22.33 c	2*3*3	25.67 i	1*2*1	73.00 jkl	2*3*3	76.33 cde
1*2*2	21.33 mn	2*3*4	23.67 jk	1*2*2	73.00 jkl	2*3*4	77.67 ab
1*2*3	21.00 n	3*1*1	27.33 h	1*2*3	73.00 jkl	3*1*1	75.00 fgh
1*2*4	19.33 o	3*1*2	27.33 h	1*2*4	74.00 hij	3*1*2	73.33 ijk
1*3*1	25.33 i	3*1*3	28.00 gh	1*3*1	76.33 cde	3*1*3	71.67 mno
1*3*2	23.33 k	3*1*4	25.67 i	1*3*2	77.00 abc	3*1*4	74.00 hij
1*3*3	23.33 k	3*2*1	32.67 c	1*3*3	76.67 bcd	3*2*1	70.33 p
1*3*4	20.00 o	3*2*2	29.33 e	1*3*4	75.00 fgh	3*2*2	71.33 nop
2*1*1	28.33 fg	3*2*3	32.67 c	2*1*1	77.67 ab	3*2*3	70.67 op
2*1*2	25.67 i	3*2*4	27.33 h	2*1*2	76.33 cde	3*2*4	75.33 efg
2*1*3	28.00 gh	3*3*1	33.67 b	2*1*3	77.33 abc	3*3*1	73.67 ijk
2*1*4	24.33 j	3*3*2	34.00 b	2*1*4	76.67 bcd	3*3*2	73.67 ijk
2*2*1	22.33 l	3*3*3	35.33 a	2*2*1	75.67 def	3*3*3	72.67 klm
2*2*2	22.00l m	3*3*4	32.33 c	2*2*2	72.67 klm	3*3*4	72.67 kml
LSD:		**0.980**				**1.186**	

Sowing times : 1.(1 November), 2. (15 November), 3. (30 November); **Varieties :** 1 (Esperia), 2 (Anapo), 3 (Genesi)
Seed fungicides: 1 (Carboxin + Thiram), 2 (Prothioconazole + Tebuconazole), 3 (Prochloraz + Tiriticonazole) and 4 (Control)

Table 3. Mean and significances of sedimentation and protein ratio

Sedimentationvalue (ml)									
Sowing time			**Variety**			**Seed fungicide application**			
1	2	3	1	2	3	1	2	3	4
34.00 b	33.44 b	47.97 a	41.69 a	31.66 b	42.06 a	39.37 b	40.85 a	37.44 c	36.22 d
LSD : 0.922				**0.643**			**0.572**		
Protein ratio (%)									
Sowing time			**Variety**			**Seed fungicide application**			
1	2	3	1	2	3	1	2	3	4
12.12 b	12.17 b	13.72 a	13.13 a	11.85 c	13.02 b	12.84 a	12.79 a	12.74 a	12.31 b
LSD : 0.051					**0.069**		**0.105**		

Sowing times : 1.(1 November), 2. (15 November), 3. (30 November); **Varieties :** 1 (Esperia), 2 (Anapo), 3 (Genesi)
Seed fungicides: 1 (Carboxin + Thiram), 2 (Prothioconazole + Tebuconazole), 3 (Prochloraz + Tiriticonazole) and 4 (Control)

Table 4. The means and significances of sowing time x variety seed fungicide interaction for sedimentation value (ml) and protein ratio (%).

Sowing time x variety x seed fungicide interaction (Sedimentation value)				Sowing time x variety x seed fungicide interaction (Protein ratio)			
1*1*1	30.00 m	2*2*3	25.33 r	1*1*1	13.60 de	2*2*3	11.03 pq
1*1*2	43.67 g	2*2*4	26.67 q	1*1*2	13.70 cd	2*2*4	11.07 pq
1*1*3	44.00 g	2*3*1	40.33 i	1*1*3	13.93 d	2*3*1	12.53 jkl
1*1*4	43.67 g	2*3*2	37.33 j	1*1*4	12.70 hij	2*3*2	12.90 gh
1*2*1	30.33 m	2*3*3	35.33 k	1*2*1	11.33 o	2*3*3	12.90 gh
1*2*2	27.00 q	2*3*4	35.67 k	1*2*2	11.07 pq	2*3*4	12.47 jkl
1*2*3	27.33 pq	3*1*1	54.33 b	1*2*3	10.93 q	3*1*1	13.43 ef
1*2*4	25.00 r	3*1*2	50.00 c	1*2*4	11.10 opq	3*1*2	13.37 ef
1*3*1	35.00 k	3*1*3	43.67 g	1*3*1	12.63 ijk	3*1*3	13.60 de
1*3*2	42.33 h	3*1*4	47.00 e	1*3*2	12.17 m	3*1*4	13.00 g
1*3*3	30.00 m	3*2*1	42.33 h	1*3*3	11.10 opq	3*2*1	13.50 def
1*3*4	29.67 mn	3*2*2	37.33 j	1*3*4	11.13 opq	3*2*2	13.27 f
2*1*1	39.33 i	3*2*3	48.33 d	2*1*1	12.83 ghi	3*2*3	13.73 cd
2*1*2	45.33 f	3*2*4	33.67 l	2*1*2	12.40 klm	3*2*4	12.37 lm
2*1*3	28.67 no	3*3*1	54.33 b	2*1*3	12.60 il	3*3*1	14.47 b
2*1*4	30.67 m	3*3*2	56.33 a	2*1*4	12.43 kl	3*3*2	14.60 ab
2*2*1	28.33 op	3*3*3	54.33 b	2*2*1	11.23 op	3*3*3	14.80 a
2*2*2	28.33 op	3*3*4	54.00 b	2*2*2	11.60 n	3*3*4	14.53 b
LSD:		**1.283**				**0.237**	

Sowing times : 1.(1 November), 2. (15 November), 3. (30 November); **Varieties :** 1 (Esperia), 2 (Anapo), 3 (Genesi)
Seed fungicides: 1 (Carboxin + Thiram), 2 (Prothioconazole + Tebuconazole), 3 (Prochloraz + Tiriticonazole) and 4 (Control)

Table 5. The mean and their significances for black point and sunn pest damage ratio.

Black point ratio (%)									
Sowing time			Variety			Seed fungicide application			
1	2	3	1	2	3	1	2	3	4
2.58	2.25	2.44	2.33	2.36	2.58	2.33 b	2.30 b	2.41 ab	2.67 a
						LSD : 0.265			
Sunn pest damage ratio (%)									
Sowing time			Variety			Seed fungicide application			
1	2	3	1	2	3	1	2	3	4
1.16	1.06	1.09	1.28 a	1.03 b	1.00 c	1.18 a	1.13 ab	1.09 bc	1.02 c
LSD :				**0.102**			**0.079**		

Sowing times : 1.(1 November), 2. (15 November), 3. (30 November); **Varieties :** 1 (Esperia), 2 (Anapo), 3 (Genesi)
Seed fungicides: 1 (Carboxin + Thiram), 2 (Prothioconazole + Tebuconazole), 3 (Prochloraz + Tiriticonazole) and 4 (Control)

Table 6. The means and significances of sowing time x variety seed fungicide interaction for black point ratio (%) and sunn pest damage ratio (%).

Sowing time x variety x seed fungicide interaction (Black point ratio)				Sowing time x variety x seed fungicide interaction (Sunn pest damage ratio)			
1*1*1	2.27 cd	2*2*3	3.00 ab	1*1*1	2.00 a	2*2*3	1.00 c
1*1*2	2.67 bc	2*2*4	3.00 ab	1*1*2	1.00 c	2*2*4	1.00 c
1*1*3	2.00 d	2*3*1	2.00 d	1*1*3	1.63 b	2*3*1	1.00 c
1*1*4	3.00 ab	2*3*2	2.00 d	1*1*4	1.10 c	2*3*2	1.00 c
1*2*1	2.33 cd	2*3*3	2.00 d	1*2*1	1.00 c	2*3*3	1.00 c
1*2*2	2.00 d	2*3*4	3.00 ab	1*2*2	1.07 c	2*3*4	1.00 c
1*2*3	3.00 ab	3*1*1	3.00 ab	1*2*3	1.07 c	3*1*1	1.00 c
1*2*4	3.33 a	3*1*2	2.00 d	1*2*4	1.07 c	3*1*2	1.93 a
1*3*1	2.00 d	3*1*3	2.00 d	1*3*1	1.00 c	3*1*3	1.00 c
1*3*2	3.00 ab	3*1*4	3.00 ab	1*3*2	1.00 c	3*1*4	1.00 c
1*3*3	3.00 ab	3*2*1	2.00 d	1*3*3	1.00 c	3*2*1	1.00 c
1*3*4	2.33 cd	3*2*2	2.00 d	1*3*4	1.00 c	3*2*2	1.07 c
2*1*1	2.00 d	3*2*3	2.67 d	2*1*1	1.60 b	3*2*3	1.07 c
2*1*2	2.00 d	3*2*4	1.00 e	2*1*2	1.10 c	3*2*4	1.00 c
2*1*3	2.00 d	3*3*1	3.33 a	2*1*3	1.00 c	3*3*1	1.00 c
2*1*4	2.00 d	3*3*2	3.00 ab	2*1*4	1.00 c	3*3*2	1.00 c
2*2*1	2.00 d	3*3*3	2.00 d	2*2*1	1.00 c	3*3*3	1.00 c
2*2*2	2.00 d	3*3*4	3.33 a	2*2*2	1.00 c	3*3*4	1.00 c
LSD:		**0.638**				**0.179**	

Sowing times : 1.(1 November), 2. (15 November), 3. (30 November); **Varieties** : 1 (Esperia), 2 (Anapo), 3 (Genesi)
Seed fungicides: 1 (Carboxin + Thiram), 2 (Prothioconazole + Tebuconazole), 3 (Prochloraz + Tiriticonazole) and 4 (Control)

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