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Effect of Seedling Age and Cycocel Consumption on Grain Yield and Lodging Related Traits in Rice (*Oryza Sativa* L.) Cultivars: Tarom Hashemi

Roja Kohi, Morteza Sam Daliri, Amir Abbas Mosavi and Hossein Bagheri

Department of Agriculture, Chaloos Branch, Islamic Azad University, Chaloos, Iran.

ABSTRACT

To evaluate the effect of seedling age and cycocel consumption (CCC) on grain yield of cultivars Tarom Hashemi, the experiment in split plot in the form of complete randomized blocks with four replications was conducted at Islamic Azad University research farm in 2009 year. Three main levels of seedling age of Hashemi Tarom variety (20, 30 and 40 days) and the sub plot with three levels of cycocel (0, 1.2, 2.4 liters.ha^{-1}) were considered. Results showed that with increasing seedling age, yield ratio decreased approximately 33 %. The maximum grain yield for seedling age of 20 and 30 days (respectively of 299.2 and 341.8 g.m^{2}). Cycocel consumption on traits such as cluster number in square meter, total number of tillers in herb and number of effective tiller in herb showed significant difference. The highest resistance to ffracture under effect of CCC 2.4 liter.ha (25.52 g/stem) and the lowest affect Under control CCC(18.35 g/stem) was observed so that the maximum grain yield for seedling age of 20 and30 days (respectively of 299.2 and 341.8 g.m^{2})

Keywords: Rice , Cycocel (CCC), Seedling Age and Grain Yield

INTRODUCTION

Rice, after wheat, is the most important agricultural product and plays a major role in feeding the world.Therefore, the acreage is devoted to rice afterwheat so that 95 percent of world rice in developing countries and 92 percent isproduced in Asia. World rice acreage is 150 million hectaresthat compared with 40 percent of wheat production is significant [1]. Seedling breeding duration in field can effect on seedling recovery in main land and rice traits and its performance. Transplant of seedling in appropriate age can provide good potential for reaching production potential by reducing blightseedlings andshorten the recovery period sets in the main land. Seedling age in most parts of Asia, at the time of transplant to the main land is about 25 to 35 days and if old seedling become more than 35 days, the yield decreases , since herb in the field began to tillering, which increased the damage to roots during the seedling out of the field [2] The appropriate seedling age for transplant depending on conditions and purposes is considered and studied experiments in international rice research institute (IRRI) showed that the best seedling age is 20-30 in wet field method, 14-18 in dry field method and 9-14 days in Dapug method.

De Data (1981) reported that the favorable seedling age for transplant is 20-25 days and seedlings, 30 days after implant in main land, have more recovery duration than young seedlings [3]. Slansel (1975) stated that favorable duration for recovery and seedling re growth in the main land is 5-7 days[4]. Existing and growing of tiller in rice are influenced by temperature and other environmental factors and recovery duration increase with transplanting seedlings to main land in more than 20-25 days [3,5]. One of the most important considerable purposes in cereals breeding is reducing herb length and increasing plant resistance against lodging [6]. The first plant growth regulator which is used to control stem length in cereals is 2-chloride [7]. The results of 2-chloride consumption in rice by Singh et al (1972) showed that rice seedlings treatment by grow slower, decreased plant light by 23 percent [8]. Experiments by Narang et al (1990) showed that rice plants sprayed with CCC may increase the density of the field from 33 to 44 in the square meters [9]. CCC may increase the number of clusters in square meters (Singh, 1995) and also e performance, whenCCC is used, control increases over [10,11]. Cycocel increase cereal resistance against stem lodging [12]. Also, Cycocel increased cell wall thickness in the internodes below the stem, reducing the angle between leaf and stem (vertical leaves), cereal straw quality by increasing the concentration of nitrogen, phosphorus and potassium in their leaves [13]. This experiment is carried out to evaluate the effect of seedling transplant age and cycocel consumption on yield and some related traits in rice cultivar Tarom Hashemi in weather conditions of Chaloos.

MATERIALS AND METHODS

This study was conducted at Research Farm of Islamic Azad University of Chaloos City of Iran in the 2009 year. Geographically, this farm located at 36 degrees and 58 minutes north latitude and 53 degrees 69minutes east of the prime meridian, and the heights 5 meters over sea level. Minimum and maximum monthly temperature 13^{O}C in May and 29.5^{O}C in July and a minimum monthly evaporation 91.8 in May and maximum monthly evaporation, 180.8 mm rainfall in July and the lowest and highest 3.2 mm and 93.5 mm respectively for the months July and August during the experiment at the nearest weather station (Noshahr) was recorded. The soil of test site to a depth of 30 cm has clay texture of EC = 0.94, PH = 7.31 ds/ m and 9% Nitrogen, Phosphorus and Potash were available in 15.375 and 134 mg/kg respectively.

the experiment in split plot randomized complete block design with four replications was conducted so that seedling age in three levels of (20, 30, and 40 days) as main factor and CCC in three levels of (0, 1.20, 2.4 liter per hectare) as sub factors which after 10 days from seedling transplant to the spray solution were used. For cultivating Hashemi Tarom rice, land was planted by the moldboard plow in early April 2009 year. After preparing land, Seeds were sterilized and germinated with100 grams per square meter of land, Nitrogen fertilizer rate of 5 grams per square meter15 days after the seeds splashing were used sonland. Before cultivation, land divided into four replicates of seedlings per hectare with dimensions of 5×2 m. Seedlings depending on the seedling age were planted to 4-5 herbs in per pile with distance of 20×20 in all plots. Soil testing and fertilizer recommendations based on soil science laboratory,50 kg of urea fertilizer in two stages, the first stage in the transfer of seedlings to 60% and 40% Padling remaining in the formation of clusters of buds were used as roads. Irrigation and weed eating worms and were uniforminall plots and tillers at the beginning of stem elongation in two stages (the active tillering stage), indicating that the Potential deal and also harvest time, indicating that fertiletillerswere counted.Atharvest time, attributessuch asnumber ofclusterper square meter, cluster length, fill and hollow grain number from each five plots and from each plant to 3 clusters were and only selected, measured and determined. Determining of 1000seedsweight by counting 10 samples from each plot after placing them with in 24 horseman oven machine with temperature of 75^{o}C with humidity of 14% was achieved. Grain yield and biological yield with harvesting herbs from 2 min the middle of each plot were harvested by removing the edge with 14% humidity and the biological yield and harvest index of grain yield was obtained. The plant length using a ruler and resistance to fracture through Prost rate and based on the amount of force required to break the fourth stem of rice was calculated (Islam et al 2007). Obtained data were analyzed using statistical software MSTATC and mean variance using Duncan's multiple range test at 5% level were compared.

RESULTS AND DISCUSSION

Cluster length:
the analysis of variance, Seedling age affected the clustering of statistically significant effect was observed at the 1 percent level but the strait sunder the age of seedlings cycocel interaction was not significant so that the most cluster length under seedling age in 20 days with 29.26 inches and the lowest cluster length in 30 and 40days (26.79 and 26.23cm, respectively) was obtained. The with using CCC and nitrogen fertilizer on winter barley crop yield increases the intake of this substance [14]

Cluster number per square meter:
The number of clusters per unit area was conducted statistically under seedling and at the one percent (Table 1). The lowest number of cluster per square meter for a seedling age of 30 and 40 days (82.79 and 89.42 cluster/square meter, respectively) and the most number for seedling age in 20 days (123.2cluster.square meter) were obtained. The most number of clusters under CCC was1.2 liter per hectare (106.8) and the lowest for CCC was2.4 liters per hectare (90.21) (Table 2). However, seedling age interaction showed no significant difference in CCC but the most cluster number for seedling age of 20 days and CCC 1.2 liter per hectare (133.5 clusters per square meter) and the lowest for seedlings age of 30 days and CCC 2.4 liters per hectare (77 clusters per square meter) was achieved. Cycocel consumption (CCC) increases the number of cluster per square meter [10]. The most cluster number per square meter in 25 sets was obtained. Alam et al. (2002) reported that with increasing seedling age from 21 to 35 days, number of clusters per unit area has reached to its maximum. It means with increasing age, the number of clusters per unit area increased [15].

Full cluster percentage:
This trait under affect of CCC at 5% level showed significant difference statistically but under seedling age and interaction effect in CCC showedno significant difference (Table 1).The most full cluster percentage under the CCC effect of 1.2 and 2.42 liters per hectare (95/97 %) and lowest one in control treatment without CCC use (94.87 %) was achieved. Gilani et al (1376) stated that between seedling ages of fertile tillers, no significant difference was observed.The most full cluster percentage and 1000seedweight were obtained from 35 days after transplanting [16].

1000 seed weigh:
In Table (1), 1000seed weight were under affect of seedling age and in one and five percent respectively. The lowest1000 seed weight for 40 day sseedling age with amount of 20.33 gandthe most one for 20 and 30 days (25.52 and 26.31 g, respectively) were obtained and alsothemost 1000 seed weight for CCC 1.2 and 2.4 liters per hectare were 25.04 and 24.64 respectively, and the lowest of 24.49 g was obtained for the control treatment (Table 2). Gilaniet al.(1376) stated that with increasing seedling age, 1000 seed weight will increase Cycocel consumption was significantly increased with reducing plant growth and increasing in weight grain filling period [16]. Cycocel plays a major role with increasing grain filling period and green plant at the end of the growing season and during grain filling [17]

Harvest index:
In the Table (1) ,harvest index showed significant difference statistically just under effect of seedling age but this trait for CCC and seedling age interaction was not significant so that the maximum harvest index for seedling age of 30, 40 days (respectively, 38.40 and 35.68 %) and the lowest harvest index for 20 days seedling age (23.28 %) was obtained and this trait for control treatment and CCC of 1.2 and 2.4 liters per hectare in one statistically group were placed (Table 2). Gilani et al (1376) stated thatharvest index increased with seedling age so that 45 days seedlings with 52.74 percent and 25 days seedling with43.17 percent respectively had the highest and the lowest harvest index [16]

Grain yield:
In Table (1) , grain yield showed significant difference statistically just under effect of seedling age in 5% level but this trait for CCC and seedling age interaction was not significant so that the maximum grain yield for seedling age of 20 and 30 days (respectively, 299.2 and 341.8 g/m^2) and the lowest grain yield for 40 days seedling age (215.9 $g.m^2$) was obtained and yield under CCC were placed in one statistically group (Table 2). However grain yield under interaction seedling age in CCC was not significant but the highest yield for 20 day seedling age in CCC1.2 (385 $g.m^2$) for the lowest yield in 40 day seedling age in CCC 2.4 liters per hectare (187.7 $g.m^2$) was achieved. With experiment in three varieties stated that 25days seedlings with an average grain 6/4 tons per hectare compared to the 35 and 45 days seedlings had12 and 16 percent respectively. The obtained results are matched with report by IRRI based on reducing 5-10 percent of the performance of high aged seedlings. Mentioned conclusion is matched with report [18] related to 20-25 days seedling optimum age for transplant and their fast planting in main land. CCC effect on grain yield and were significant and increases grain yield. According to tests by Franke and Hassanein(1979), grain yield in plants under CCC showed significant difference [19].

Plant height:
Plant height of seedling age and CCC were significant statistically at 1and 5percent respectively, but the interaction was no significant (Table 4). The maximum plant height for 40 days seedling age (139.2cm) and the lowest for 30

day seedling age (123.2 cm) for the maximum plant height for control (136.6cm) and lowest for CCC 1.2 liter in hectare (125.9cm) was observed (Table 5). Although this trait under the seedling age interaction was not significant in CCC but the maximum plant height of 20 days seedling age in the control group(148.4cm) and the lowest plant height of 30 days seedling age in CCC treatment ½ liter in hectare (119.9cm) were obtained. Herb height was control to treatment when wheat was placed in vase and or field under effect of 2-chloride, the stem length was shortened [20].

Internodes diameter:
As was observed in the variance analysis, the diameter of the fourth internodes was not significant under affect of seedling age interaction and CCC (Table 4) so that the maximum diameter of the internodes of the 40 days seedling age of (4.932 mm) and minimum diameter of the internodes of the 30 days seedling age (4.733 mm) and maximum diameter of the internodes under CCC 2.4 liters per hectare (5.011 mm) and the lowest under CCC 1.2 liter per hectare (4.747 mm) was observed. The internodes diameter under the seedling age interaction and CCC was found significant, but most of the internodes diameter of 40 days seedling age and CCC 2.4 liters per hectare (5.2 mm) and the lowest under the 30 days seedling age and CCC 1.2 liter per hectare (4.443 mm) was observed. Use of CCC with concentration of 1.5 liter per hectare increase stem diameter, although the changes were not statistically significant ($P<0.05$) [20].

Internodes length:
As was observed in the variance analysis, the internodes length under effect of seedling age and seedling age interaction in CCC was not significant but under affect of CCC in 5% level was significant (Table 4) so that the maximum internodes lengthunder 40 days seedling age (9.137cm) and minimum internodes length of the 30 days seedling age (7.421cm). Also, the maximum internodes length under control CCC (10.42cm) and the lowest under CCC 1.2 liter per hectare (7.496cm) were obtained (Table 4). The internodes length of seedling age interaction was not significant in most CCC internodes length for 40 days seedling age and control (11.60cm) and internodes length for the lowest 30 days seedling age and CCC 1.2 liter in hectare (6.247) was observed.

Resistance of Fracture:
According to the variance analysis of resistance to fracture under effect of CCC was statistically significant at the 5% level but seedling age and seedling age interaction in CCC had no effect (Table 4). The highest resistance of fracture under effect of seedling gage (23.77 g/stem) and the lowest fracture resistance at 20 days seedling age (20.58 g/stem) and the highest resistance to fracture under effect of CCC 2.4 liters in hectare (25.52 g/stem) and the lowest affect under control CCC (18.35 g/stem) was observed (Table 4). However resistance of fracture under the effect of seedling age in CCC was not significant but the highest resistance of fracture under effect of 30 days seedling age and CCC2.4 liters per hectare (26.80 g/stem) and the lowest affected by 20 days seedling age in the control group(16.38 g/stems)was placed.

Table (1) Mean squares of yield and related traits affected seeding age and ccc

Grain yield	Harvest index	1000 seed weight	Effective tillers	Full duster percentage	Duster number	Duster length	Df	Source changes
0.008	116.237	5.62	17.917	3.863	526.988	1.655	3	**Replicate**
0.049 *	779.738**	126.647**	46.797**	0.695 ns	5626.188**	31.213**	2	**Seeding Age**
0.006	36.570	5.059	2.639	1.301	1590.919	2.716	6	**Error(a)**
0.017 ns	99.516 ns	22.611*	5.871*	3.685*	829.313**	1.541 ns	2	**Cycocel**
0.010 ns	159.203 ns	6.820 ns	2.974 ns	1.829ns	75.438 ns	4.077 ns	4	**Seeding Age in Cycocel**
0.008	90.941	3.874	1.849	1.382	136.470	4.349	18	**Error(b)**
29.38	30.51	8.18	9.87	1.23	11.86	7.6	--	**CV %**

**, **: showingthesignificantdifferenceinlevels1% and5%.*
Ns: showing the non-significant difference.

Table(2) Simple comparison of performance and some related trails

Grain Yield	Harvest Index	1000 Seed Weight	Effective Tillers	Full Duster Percentage	Duster Number	Duster Length	Treatment/Traits
299.2 a	23.28 b	25.52 a	15.79	-	123.2 a	29.26 a	**20 days seeding age**
341.8 a	35.68 a	26.32 a	13.73 b	-	89.42 b	26.23 b	**30 days seeding age**
215.9 b	38.40 a	20.33 b	11.84 c	-	82.79 b	26.79 b	**40 days seeding age**
-	-	23.49 b	13.03 b	94.87 b	98.33 ab	-	**Control (0)**
-	-	25.04 a	14.42 a	95.97 a	106.8 a	-	**Cycocel 1.2**
-	-	24.64 a	13.90 ab	95.46 ab	90.21 b		**Cycocel 2.4**

Means that place in a column with at least one common letter is in statistical group.

Table (3) Variance analysis related to lodging traits internodes diameter

Internodes length	Internodes diameter	Resistance to Fracture	Flag leaf angle	Plant height	DF	Source changes
9.366 ns	0.310 ns	45.088 ns	127.000 ns	104.050 ns	3	**Replicate**
11.494 ns	0.148 ns	30.542 ns	190.021*	77.547**	2	**Seeding Age**
8.385	0.361	46.622	53.243	40.720	6	**Error(a)**
31.276*	0.221 ns	156.992*	1219.646**	350.037*	2	**Cycocel**
1.890 ns	0.156 ns	3.690 ns	19.167 ns	52.036 ns	4	**Seeding Age in Cycocel**
6.390	0.457	30.029	28.169	65.140	18	**Error(b)**
29.53	13.90	24.66	9.77	6.13	--	**CV %**

**, **: showingthesignificantdifferenceinlevels1% and5%.*
Ns: showing the non-significant difference.

Table (4) Comparison of simple traits associated rires

Fourth internodes length	flag leaf angle	Harvest index	Plant height	Treatment
-	57.21a	-	139.2 a	**20 Days Seedling Age**
-	56.00 a	-	123.2 b	**30 Days Seedling Age**
-	49.79 a	-	132.8 a	**40 Days Seedling Age**
10.42 a	45.71 c	18.35 b	136.6 a	**Control (0)**
7.496 b	65.42 a	22.79 ab	125.9 b	**Cycocel 1.2**
7.768 b	51.88 b	25.52 a	132.7 ab	**Cycocel 2.4**

In each treatment, means followed by the same letter are not significantly different at P≤0.05.

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