AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/aeb.html

The Study of Lodging Occurrence Stages on Grain Yield Damages and Agronomical Traits of Two Rice Cultivars (Tarom and Shiroodi)

[1]P. Haghdoost, [2]M. Sam Daliri, [3]M. Mohamadian, [1]T. Ghasm

[1]Department of Agriculture, Chaloos Branch, Islamic Azad University, Chaloos, Iran.
[2]Associate professor, Department of Agriculture, Islamic Azad University, Chaloos Branch, Iran.
[3]Faculty member of Rice Research Institute of Iran (Deputy of Mazandaran - Amol), Iran.

ARTICLE INFO

Article history:
Received 15 April 2014
Received in revised form 22 May 2014
Accepted 25 May 2014
Available online 15 June 2014

Keywords:
Grain yield, lodging damage, Physiological growth stages, Rice.

ABSTRACT

This study was aimed to investigate, lodging occurrence stages on grain yield damages and agronomical traits of two rice cultivars (Tarom and Shiroodi), were carried out at the experimental farm of Amol (36.3◦E and 52.2◦N; 110 m elevation), Iran, in 2012. The experiment was a split –plot and in randomized complete block design with three replications. Two cultivars (Tarom and Shiroodi) were involved in main plot and artificial lodging performed at growth stages (panicle initiation, booting, milky, dough and ripening stages) along with control (non-lodging) has been set in sub- plot on main plot experiment layout. Analysis of variance showed that there was significant difference between two main plots (two cultivars). Experimental results showed that creating of artificial lodging in different stages, on all traits were significant ($p<0.01$). It also found that if the lodging occurs in early growth stages such as panicle initiation, the damage of lodging, i.e. loss of grain yield, will be greater so that grain yield of creating of artificial lodging in panicle initiation was lesser than 58.3 and 57.4 comparison to control treatment (unlodged plot) in Tarom and Shiroodi, respectively.

To Cite This Article: P. Haghdoost, M. Sam Daliri, M. Mohamadian, T. Ghasm., The Study of Lodging Occurrence Stages on Grain Yield Damages and Agronomical Traits of Two Rice Cultivars (Tarom and Shiroodi). ***Adv. Environ. Biol., 8(9),*** *914-917, 2014*

INTRODUCTION

Rice is a second main staple crop after wheat in Iran, cultivated in 570,000 hectares of irrigated area and 2.4 million tons of milled rice is produced. Iran still largely depends on rice imports to the tune of 0.8 million tons each year to meet the domestic consumer's demand. Therefore, hybrid rice with 20-25% yield heterosis over conventional varieties happens to be the only viable option to enhance the production and productivity levels, since the area under rice cultivation cannot be further increased due to water shortages [5]. Lodging is a major problem in the production of cereal crops. Addition to decreasing productivity, lodging also decreases the quality of the rice grains in lodged plants [14]. The lower yield and decreased quality also lead directly to poor profits for farmers. It also causes difficulties in harvest operations and consequently results in increased production cost [15]. Lodging in rice may occur as a result of strong winds, heavy rain, water management, planting density, or an excessive use of fertilizer [1,6].The loss of grain yield in lodged plants differs with the state of lodging and the time of lodging [19]. Lodging has been one of the important constraints on rice production for a long time. When lodging occurs, the canopy structure would be destroyed, and the capacity of photosynthetic rate and dry matter production sharply reduced [9]. In severe cases, it breaks stems or pulls the roots out, blocking the transportation of water, minerals and photosynthetic, leading to a substantial decline in yield and quality [3,16]. In recent years, as high-yielding rice cultivars characterized by large panicle, as well as simplified planting techniques such as direct-seeding and seedling broadcasting, are widely applied, the potential risk of lodging is increasing. In light of this, more and more attention has been paid to it, and many findings such as the causes for lodging, lodging damage mechanism, the prevention of lodging have been reported [4,11,12]. However, the effects of lodging time, which is always uncertain for its concern with irregular severe weather or pests and diseases, are still rarely studied so far. According to this situation, this study was lodging occurrence stages on grain yield damages and agronomical traits of two rice cultivars (Tarom and Shiroodi).

Corresponding Author: Pari Haghdoost, Department of Agriculture, Chaloos Branch, Islamic Azad University, Chaloos, Iran.
E-mail: Haghdoost2014@gmail.com

MATERIAL AND METHODS

The experiments were carried out at the experimental farm of Amol (36.3◦E and 52.2◦N; 110 m elevation), Iran, in 2012. The climate of this region is close to the warm Mediterranean climate, clear heat that, summers with high humidity and high temperature, with low rainfall and mild winters with copious precipitation. The experiment was a split –plot and in randomized complete block design with three replications. Two cultivars (Tarom and Shiroodi) were involved in main plot and artificial lodging performed at growth stages (panicle initiation, booting, milky, dough and ripening stages) along with control (non-lodging) has been set in sub- plot on main plot experiment layout. Before conducting the experiment, surface composite soil samples was taken and some properties of soil such as T.N.V., texture, P and K available, %O.C, pH and EC were analyzed. N, P and K fertilizers applied after soil analysis based on technical instructions of Rice Research Institute. For varieties Tarom Hashemi, urea nitrogen level of 100/ ha in turn three, Form (40 % base, 30 % of the tillering stage , 30 % in young heading) and the source of phosphorus fertilizer triple superphosphate at a rate of 75 ($kg.ha^{-1}$) and Potassium fertilizer, potassium sulfate at a rate of 100 ($kg.ha^{-1}$), Form (50 % base, 50 % in young heading) and zinc fertilizers, of zinc sulfate was consumed at a rate of 25 kg per hectare ($kg.ha^{-1}$). Farm management during the growth stage of weed control, Pest and disease etc. Rice Research Institute was conducted in accordance with the Technical Instructions. Plot size was 12 m^2 per treatment and seedlings were transplanted at 25 × 25cm spacing. Artificial lodging was made by pushing of plant stem into the ground in predicted stages. Grain yield, harvest index, tiller number, N content of grain and N uptake was calculated and the data were evaluated basis on statistical. 12 hill bottom-cut plant samples were taken in each plot to determine the dry matter and harvest index at physiological maturity. Grain and straw samples were analyzed for N content. Grain yields (14% moisture content) were measured at harvest from a 5 (m^2) sample area per plot and converted to ton per hectare. All data collected in this study were subjected to analysis of variance (ANOVA) using SAS statistical program Mean comparisons were conducted with Duncan ($p<0.05$) using SAS software [13].

RESULTS AND DISCUSSION

Seed yield:

As the analysis of variance table (Table 1) shows, effect of variety and treatment effect (the creation of artificial lodging) and interaction effect variety * treatments on grain yield was significant ($p<0.01$). The study of interaction effected of varieties in various stages of lodging on seed yield showed that, Tarom variety of highest seed yield of the control treatment (no lodging) (6535 $kg.ha^{-1}$) and minimum seed yield of the treated creating artificial lodging , heading in the young (2723 $kg.ha^{-1}$), are obtained (Table 2). The highest and lowest grain yield in varieties of Shirudi obtained the same two treatments (9975, 4242 $kg.ha^{-1}$). As a result, if the lodging in the primitive stages of growth occurs, damage to the lodging is reduced further yield and Upside yield levels approaching the lodging creation stage, the developmental stage of the plant, this is proof. Lodging is more effective elements in grain yield [9,18]. Photosynthetic capacity and dry matter production were decreased by change of planting densities and normal canopy condition [3] Grains may grow on panicle in lie down plants, so it caused to decrease quality and quantity of grain, therefore lodging caused to increase cost of production by disorder in harvesting time and increase of grain drying [4,17].

Harvest index:

As the analysis of variance table (Table 1) shows, effect of variety and treatment effect (the creation of artificial lodging) and interaction effect variety * treatments on harvest index was significant ($p<0.01$). The study of interaction effected of varieties in various stages of lodging on harvest index showed that, Tarom variety of highest harvest index of the control treatment (no lodging) (0.47 %) and minimum harvest index in stage of Started of Young heading (0.31%), are obtained (Table 2).

Number of Tillers:

As the analysis of variance table (Table 1) shows, effect of variety and treatment effect (the creation of artificial lodging) on number of tillers was significant ($p<0.01$). Also, interaction effect variety * treatments on number of tillers non significant. The study of interaction effected of varieties in various stages of lodging on number of tillers showed that, Tarom variety of highest number of tillers of the control treatment (no lodging) (20.6) and minimum number of tillers in stage of Started of Young heading (17.6), are obtained (Table 2).

Grain nitrogen concentration:

As the analysis of variance table (Table 1) shows, effect of variety and treatment effect (the creation of artificial lodging) and interaction effect variety * treatments on grain nitrogen concentration was significant ($p<0.01$, 0.05). The study of interaction effected of varieties in various stages of lodging on grain nitrogen

concentration showed that, Tarom and Shirodi variety of highest grain nitrogen concentration of the control treatment (no lodging) , Started of Young heading, Dough stages (with 0.02 %) are obtained (Table 2).

Grain N uptake:

As the analysis of variance table (Table 1) shows, effect of variety and treatment effect (the creation of artificial lodging) and interaction effect variety * treatments on grain N uptake was significant ($p<0.01$). The study of interaction effected of varieties in various stages of lodging on grain N uptake showed that, Shirodi variety of grain N uptake index of the control treatment (no lodging) (182) and minimum grain N uptake in stage of Started of Young heading in Tarom variety (54.8), obtained.

Table 1: Analysis of variance on some agronomic traits.

SOV	DF	Seed yield ($Kg.ha^{-1}$)	Harvest Index (%)	Number of Tillers	Grain nitrogen concentration	Grain N uptake
Replication	2	ns	ns	ns	ns	ns
Variety	1	**	**	**	**	**
Error (a)	2	9662	0.0	0.25	0.0	3.58
Lodging time stages	5	**	**	**	**	**
Variety* Lodging time	5	**	**	ns	*	**
Error (b)	20	8845	0.0	0.65	0.0	8.82
CV %	-	1.61	1.02	3.08	2.4	2.61

ns, * and ** : Non significant at the 5 and 1% levels probability respectively.

Table 2: Main Comparison of some agronomic traits (Variety*lodging time).

Treatment (Variety*lodging time)		Seed yield ($Kg.ha^{-1}$)	Harvest Index (%)	Number of Tillers	Grain nitrogen concentration	Grain N uptake
Tarom	Non-Lodging	6535d	0.47c	20.6c	0.02a	131.4c
	Started of Young heading	2723h	0.31h	17.6e	0.02a	54.8g
	Perfect Panicle	2893h	0.32h	18.3de	0.019a	55.7g
	Milky	4055g	0.4f	18.7cde	0.019a	80.5f
	Dough	5143f	0.44d	19.3cde	0.02a	103.3e
	harden	6532d	0.48b	20.3cd	0.019a	128.09c
Shiroodi	Non-Lodging	9975a	0.49a	36.3a	0.018a	182.5a
	Started of Young heading	4245g	0.35g	31.3b	0.019a	83.29f
	Perfect Panicle	5793e	0.39f	31.6b	0.019a	111.07d
	Milky	6668d	0.42e	32.3b	0.019a	130.43c
	Dough	7461c	0.45e	32.6b	0.020a	151.15b
	harden	8017b	0.45d	34.6b	0.018a	151.51b

Means with similar letter were not significant at the 5% probability level.

Conclusion:

Rice is the staple food of much of humanity, and this paper examined a method of militating against a particular constraint on rice production, lodging. Lodging may cause the loss of grain yield and quality [2,13], and so it is vitally important to develop methods to reduce lodging.

REFERENCES

[1] Aeslina Abdul Kadir, Alida Abdullah, Lee Kah Wai, 2013. Study on Ferum (Fe) and Zinc (Zn) Removal by using Rice Bran at Sungai Pelepah, Kota Tinggi, Johor, Advances in Environmental Biology, 7(12): 3580-3586.

[2] Back, N.H., S.S. Kim, M.G. Choi, W.H. Yang, H.T. Shin, S.Y. Cho, 1998. Effect of slow release compound fertilizer application rate on growth and yield of rice in direct seeding on flooded paddy surface. RDA J Agro-Env Sci., 40: 35-41.

[3] Cooper, R.L., 1971. Influence of early lodging on yield of soybean. Agron Journal, 63: 449-450.

[4] Ferdushi, F., A. AbdulbasahKamil, 2013. Factors affecting rice farm in Bangladesh: A Stochastic Frontier Approach, American-Eurasian Journal of Sustainable Agriculture, 7(5): 426-432.

[5] Hitaka, H., 1969. Studies on the lodging of rice plants, *Japanese Agric. Res.*,, 4(3): 1-6.

[6] Hoshikawa, K., S.B. Wang, 1990. Studies on lodging in rice plants. I. A general observation on lodged rice culms, *Japanese, J. of Crop Sci.,* 59: 809-814.

[7] Kashiwagi, T., H. Sasaki, K. Ishimaru, 2005. Factors responsible for decreasing sturdiness of the lower part in lodging of rice (*Oryza sativa* L.). *Plant Prod Sci.*, 8(2): 166-172.

[8] Li, H.J., X.J. Zhang, W.J. Li, Z.J. Xu, H. Xu, 2009. Lodging resistance in japonica rice varieties with different panicle types. Chin J Rice Sci., 23(2): 191-196.

[9] Mohemi, M., M. Lari, E. Jafari, S.E. Hosseini, 2013. The relationship between Ownership Structure and Stock Price Volatility with Dividend in Listed Firms of TehranStock Exchange, Advances in Environmental Biology, 7(13): 4333-4338.
[10] Nematzadeh, G.A., A. Abubacker Jauhar, M. Sattari, A. Valizadeh, E. Alinejad, M.Z. Nouri, 2006. Relationship between different allogamic associated trait characteristics of the five newly developed cytoplasmic male sterile (cms) lines in rice. Journal of central European agriculture, 7(1): 49-56.
[11] Salar, M., Mobasser, A. Ghanbari-Malidarreh, 2013. Effects of nitrogen and potassium rates of mother plant on seed N and K content, germination and seedling growth of rice seeds, Advances in Environmental Biology, 7(1): 147-151.
[12] Salar, M., M. Mobasser, M. Mobaleghi, 2013. Interaction Effects of Nitrogen And Potassium Rates on Agronomical Traits of Rice, Advances in Environmental Biology, 7(13): 3963-3968.
[13] SAS Institute, 2002. SAS/GRAPH Software: Reference Volume 1, Version 8, Cary, NC: SAS Institute Inc.
[14] Setter, T.L., E.V. Laureles, A.M. Mazaredo, 1997. Lodging reduces yield of rice by self-shading and reductions in canopy photosynthesis. Field Crops Res., 49: 95-106.
[15] Sharifianpour, G., A.R. Zaharah, 2013. Elucidating the Expression of Zinc Transporters Involved in Zinc Uptake by Upland Rice Landraces in Malaysia, Advances in Environmental Biology, 7(14): 4854-4857.
[16] Song, D.S., Y.J. Kim, S.C. Lee, 1996. Effects of seeding dates on lodging in water seeding of rice. *Korean J Crop Sci*., 41: 157-167.
[17] Xiao, Y.H., L.H. Luo, X.Y. Yan, Y.H. Gao, C.M. Wang, L. Jiang, M. Yano, H.Q. Zhai, J.M. Wan, 2005. Quantitative trait locus analysis of lodging index in rice (*Oryza sativa* L). *Acta Agron Sin*., 31(3): 348-354.
[18] Zhang, Q.Y., Y.N. Ouyang, W.M. Dai, S.M. Yu, J.Y. Zhuang, Q.Y. Jin, S.H. Cheng, 2005. Relationship between traits of basal elongating internodes and lodging and QTL mapping in rice (Oryza sativa L). Acta Agron Sin., 31(6): 712-717.
[19] Zossou, S.H. Norliette, 2Agbangba Codjo Emile, 2013. Rhamphicarpa fistulosa in Lowland Rice Production in Africa: a Review, Advances in Environmental Biology, 7(14): 4567-4572.