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Determination of Yield and Quality Parameters in Some Paddy Genotypes (*Oryza sativa* L.) by Correlation Analysis

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Abstract: In this study, it was aimed to determine the correlation between yield and quality parameters of some paddy genotypes (*Oryza sativa* L.) by correlation analysis. The research; Erbaa, Niksar, Pazar locations in 2016 and 2017 vegetation period was carried out using 15 paddy genotypes. The experiments were established with four replications according to the Randomized Blocks Experimental Design. Genotypes were examined according to *Spearman* correlation test. Paddy yield (*PY*) and panicle heading time (*PHT*, r = 0.163 *), maturation time (*MT*, r = 0.252 *), the number of grains per panicle (*NGP*, r = 0.325**), thousand grain weight (*TGW*, r = 0.159 *), the number of productive tillers per square meter (*TNPM*, r = 0.282**), single panicle yield (*SPY*, r = 0.188 *), broken rice yield (*BRY*, r = 0.721 **), unbroken rice yield (*UBRY*, r = 0.502 *), harvest index (*HI*, r = 0.651 **) was a significant positive correlation between them. In terms of quality, there was significant positive correlation between broken (*BRY*) or unbroken (*UBRY*) rice yield and the number of grains per panicle (*NGP*, r = 0.768 **), the number of productive tillers per square meter (*TNPM*, r = 0.629 **), harvest index (*HI*, r = 0.729 **, r = 0.503 *, respectively). The data obtained from the investigated properties will help breeders in breeding superior paddy genotypes in yield and quality.

Keywords: Paddy, Genotype, Quality, Correlation, Yield

Bazı Çeltik Genotiplerinde (*Oryza sativa* L.) Verim ve Kalite Parametrelerinin Korelasyon Analizi ile Belirlenmesi

Öz: Bu çalışmada, bazı çeltik genotiplerinin (*Oryza sativa* L.) verim ve kalite parametreleri arasındaki ilişki korelasyon analizi ile belirlenmesi amaçlanmıştır. Araştırma; Erbaa, Niksar, Pazar lokasyonlarında 2016 ve 2017 vejetasyon döneminde 15 çeltik genotipi kullanılarak gerçekleştirilmiştir. Denemeler, Tesadüf Blokları Deneme Desenine göre dört tekerrürlü olarak kurulmuştur. Çalışmadan elde edilen sonuçlar, *Spearmanftable* korelasyon testine göre incelenmiştir. Çeltik verimi (*PY*); salkım çıkarma süresi (*PHT*, r = 0.163*), olgunlaşma süresi (*MT*, r = 0.252*), salkımda tane sayısı (*NGP*, r = 0.325**), bin tane ağırlığı (*TGW*, r = 0.159*), metrekarede salkım sayısı (*TNPM*, r = 0.282**), tek salkım verimi (*SPY*, r = 0.188*), kırıklı pirinç randımanı (*BRY*, r = 0.721**), kırıksız pirinç randımanı (*UBRY*, r = 0.502*), hasat indeksi (*HI*, r = 0.651**) aralarında önemli pozitif korelasyon belirlenmiştir. Kalite bakımından kırıklı (*BRY*) veya kırıksız (*UBRY*) pirinç randımanı ile salkımda tane sayısı (*NGP*, r = 0.768**), metrekarede salkım sayısı (*TNPM*, r = 0.629**), hasat indeksi (*HI*, sırasıyla; r = 0.729**, r = 0.503*) aralarında önemli pozitif korelasyon saptanmıştır. İncelenen özelliklerden elde edilen veriler, verim ve kalite bakımından üstün çeltik genotipi elde etmek amacıyla yapılan ıslah çalışmalarında faydalı olacaktır.

Anahtar Kelimeler: Çeltik, Genotip, Kalite, Korelasyon, Verim

1. Introduction

Paddy cultivation in the world; in 167.3 million hectares of area, the cultivation area ranks third with 769.7 million tons of production and second with 460 kg da^{-1} yield (Anonymous, 2017).

World paddy production is the highest in Asian countries, China (212.7 million tons), India (168.5 million tons) and Indonesia (81.4 million tons) are the countries that produce the highest paddy (Anonymous, 2017). In Turkey, 940 thousand tons rice has produced, 782 kg per hectare obtained yield about 120 thousand hectares in the production area (Anonymous, 2018). The cultivation of the paddy plant originating from the southeast region of India in

China, started about 500 years ago than Turkey (Kün, 1996). Rice has a rich carbohydrate content compared to other cereal types and it is the most consumed nutrient after wheat in human nutrition among cereal types (Elci et al., 1994). The percentage of essential amino acids lysine and threonin have high amount for people in rice to compared with many plants. Rice and its derivatives, which are consumed in Asian countries, possess the important portion of the daily required plant proteins and this increases the importance of paddy (Duff, 1991; Sürek, 2002). In different regions of the world; There are different production systems such as shallow water, base land and prairie paddy in humid climate areas, deep water and floating paddy, and deep water cultivation is the most preferred system by the producers in our country (Sezer et al., 2012). In this context, it is essential that the agricultural areas are irrigable and that the water need of the plant is met in the areas where paddy cultivation will be made (Hairmansis et al., 2008). When there is a decrease in the amount of paddy production in the world and in our country, rice prices or the prices of food products made from rice increase and directly affect the consumer. Different properties are effective in yield and quality in rice and are called as yield and quality components. The characters have examined the direct and indirect effects (Jennings et al., 1979). The parameters having direct and indirect effects in terms of grain yield and quality are determined by correlation analysis (Dewey and Lu, 1959; Milligan et al., 1990; Oad et al., 2002; Babar et al., 2007). Thus, the relationship between grain yield and quality of the parameters examined is provided with a net understanding (Rasheed et al., 2002). Especially during the development of varieties, the traits with high impact in terms of yield and quality are of great importance (Zahid et al., 2006). In our country to increase the amount of rice production; determination of paddy genotypes with high yield and quality parameters in the unit area. Adaptation to the ecological conditions of the region, and determination of correlation levels of parameters affecting yield and quality are extremely important for breeder and cultivation.

Table 1. Genotypes used in the research and the organizations
Çizelge 1. *Çalışmada kullanılan çeşitler ve temin edildiği kuruluşlar*

Genotypes	**Provided Organizations**
Halilbey	Thrace Agricultural Research Institute
Osmancık-97	Thrace Agricultural Research Institute
Şumnu	Thrace Agricultural Research Institute
Edirne	Thrace Agricultural Research Institute
Çakmak	Thrace Agricultural Research Institute
Kızıltan	Thrace Agricultural Research Institute
Efe	Thrace Agricultural Research Institute
Mis 2013	Thrace Agricultural Research Institute
Tosyagüneşi	Thrace Agricultural Research Institute
Hamzadere	Thrace Agricultural Research Institute
Cammeo	Harman Agricultural Seed Food Marketing Trade
Meco	Harman Agricultural Seed Food Marketing Trade
Ronaldo	Tekcan Seed, Food and Agricultural Products Industry
Nembo	Tekcan Seed, Food and Agricultural Products Industry
Vasco	Tekcan Seed, Food and Agricultural Products Industry

2. Materials and Method

A total of 15 genotypes were used in this study genotypes from two private sectors and one public institution (Table 1). The study were carried out Erbaa (altitude 230 m), Niksar (altitude 350 m) and Pazar (altitude 540 m) the locations to between 40 ° 16 'latitude and 36 ° 28' longitude. The experiments were established with four replications according to the Randomized Blocks Experimental Design (Babu et al., 2012).

Average data were obtained from three locations. The data were statistically analyzed by using *SPSS Statistics 17.0* programme *Spearman* correlation method.

3. Results and Discussion

Panicle heading time (*PHT*) with panicle height (*PH*) between 5% positive, and number of grains per panicle (*NGP*), thousand grain weight (*TGW*) 5% negative, maturation time (*MT*) has been determined among the important correlation of 1% positive. There was a 5% positive correlation between maturation time (*MT*) and plant height (*PLH*), 5% negative correlation between thousand grain weight (*TGW*) and 1% positive correlation between panicle height (*PH*). In similar studies, the researchers have reported that there was a significant positive correlation between panicle heading time, panicle height and maturation time, and a significant negative correlation between number of grains per panicle and thousand grain weight (Aguilar and Grau, 2006; Şahin et al., 2011; Tripathi et al., 2013; Riaz et al., 2014). Significant correlation was found between plant height (*PLH*) with thousand grain weight (*TGW*) 5% positive, and between sterility (*ST*) 5% negative, and 1% positive between panicle height (*PH*). Sezer and Köycü, (1997), Şahin et al. (2011) reported a significant positive correlation between plant height and thousand grain weight and panicle height, however significant negative correlation between sterility. Similar studies conducted in different countries have also found a significant positive correlation between plant height and panicle height (Sreewongchai et al., 2017). Significant correlation was found between panicle height (*PH*) and thousand grain weight (*TGW*), the number of productive tillers per square meter (*TNPM*), sterility (*ST*) 5% positive and single panicle yield with 5% negative (*SPY*) (Table 2). A significant positive correlation has determined between panicle height and thousand grain weight (Şahin et al., 2011). There was a 5% positive correlation between number of grains per panicle (*NGP*) and harvest index (*HI*), and 1% positive between the number of productive tillers per square meter (*TNPM*) (Table 2). In the research conducted to Thrace conditions, a significant positive correlation was found between number of grains per panicle and harvest index (Sürek and Beşer, 2003). A significant positive correlation has determined between the number of productive tillers per square meter (*TNPM*) and single panicle yield (*SPY*), which is an important yield parameter in cereals. In research, paddy yield (*PY*) with panicle heading time (*PHT*), maturation time (*MT*), thousand grain weight (*TGW*), single panicle yield (*SPY*), unbroken rice yield (*UBRY*) were found to be 5% positive correlation, and number of grains per panicle (*NGP*), the number of productive tillers per square meter (*TNPM*), broken rice yield (*BRY*), harvest index (*HI*) 1% positive significant correlation, and sterility (*ST*) 5% negative, and cargo protein yield (*CPY*), panicle height (*PH*) significant negative correlation was determined at 1% level (Table 2). Similar results have been obtained in studies conducted by different researchers (Wright, 1921; Amirthadevarathinam, 1983; Reddy et al., 1995; Roy et al., 1995; Singh et al., 1995; Yolanda and Das, 1995; Reddy et al., 1997; Meenakshi et al., 1999; Janardhanam et al., 2001; Nayak et al., 2001; Prasad et al., 2001; Iftikharuddaula et al., 2002; Madhavilatha, 2002; Satish et al., 2003; Sürek and Beşer, 2003; Khedikar et al., 2004; Yogameenakshi et al., 2004; Bhatti et al., 2005; Riaz et al., 2014). Rice is an important quality parameter that is broken rice yield (*BRY*) with unbroken rice yield (*UBRY*) 5% positive, paddy yield (*PY*), number of grains per panicle (*NGP*), the number of productive tillers per square meter (*TNPM*), harvest index (*HI*) 1% positive, and sterility (*ST*) was found to the between 5% significant negative correlation (Table 2). Unbroken rice yield (*UBRY*) with paddy yield (*PY*), harvest index (*HI*) were found 5% positive correlation, and sterility (*ST*) 5% negative. Plant height (*PLH*), panicle height (*PH*) and paddy yield (*PY*) with a negative significant correlation was observed the 5% level in terms of cargo protein yield (*CPY*).

Table 2. Correlation analysis results of examined parameters
Çizelge 2. *İncelenen parametrelerin korelasyon analiz sonuçları*

	MT	*PLH*	*PH*	*PY*	*NGP*	*TGW*	*TNPM*	*SPY*	*ST*	*BRY*	*UBRY*	*CPY*	*HI*
PHT	0.904**	-0.227	0.581*	0.163*	-0.247*	-0.580*	0.241	0.419	-0.016	-0.070	-0.056	0.268	-0.094
	0.000	0.207	0.012	0.021	0.048	0.012	0.193	0.060	0.477	0.402	0.421	0.167	0.370
MT		0.212*	0.607**	0.252*	-0.248	-0.481*	0.184	0.422	-0.045	-0.208	-0.034	0.222	-0.238
		0.024	0.008	0.012	0.187	0.035	0.256	0.059	0.436	0.229	0.452	0.213	0.196
PLH			0.647**	0.258	-0.415	0.260*	-0.395	-0.392	-0.218*	-0.303	-0.041	-0.559*	-0.254
			0.005	0.177	0.062	0.035	0.072	0.074	0.019	0.136	0.443	0.015	0.181
PH				-0.214**	-0.021	0.101*	0.354*	-0.464*	0.232*	-0.038	0.178	-0.575*	-0.025
				0.002	0.470	0.041	0.038	0.041	0.023	0.446	0.263	0.012	0.464
PY					0.325**	0.159*	0.282**	0.188*	-0.497*	0.721**	0.502*	-0.203*	0.651**
					0.009	0.016	0.004	0.041	0.030	0.001	0.028	0.034	0.004
NGP						0.516	0.760**	0.297	-0.291	0.768**	0.381	-0.010	0.468*
						0.204	0.001	0.141	0.146	0.000	0.081	0.486	0.039
TGW							0.224	-0.135	-0.202	0.372	0.218	0.112	0.363
							0.211	0.316	0.235	0.086	0.217	0.346	0.092
TNPM								0.661**	-0.213	0.629**	0.178	-0.016	0.347
								0.004	0.223	0.006	0.263	0.478	0.103
SPY									-0.320	0.362	0.243	-0.193	0.114
									0.123	0.093	0.192	0.245	0.343
ST										-0.493*	-0.446*	-0.129	-0.368
										0.031	0.048	0.323	0.089
BRY											0.454*	-0.030	0.729**
											0.045	0.458	0.001
UBRY												-0.182	0.503*
												0.258	0.028
CPY													0.093
													0.370

*, **; 5% and 1% respectively are statistically significant

4. Conclusion

According to the results obtained from the study carried out for two years in three different locations, panicle heading time (*PHT*), maturation time (*MT*), number of grains per panicle (*NGP*), thousand grain weight (*TGW*), the number of productive tillers per square meter (*TNPM*), single panicle yield (*SPY*), broken rice yield (*BRY*) and unbroken rice yield (*UBRY*), harvest index (*HI*) parameters are positively important in paddy yield (*PY*), number of grains per panicle (*NGP*), the number of productive tillers per square meter (*TNPM*), harvest index (*HI*), broken rice yield (*BRY*) and unbroken rice yield (*UBRY*) was found to have a significant positive correlation in terms of quality parameters.

According to the data obtained, in order to collect the rice demand in Turkey, it is necessary to determine paddy genotypes with high yield and quality from the unit area. The parameters and correlation levels are important for the development of varieties suitable for paddy cultivation areas with high yield and quality performance. The examined parameters significant positive correlation between some traits on yield and quality will help breeders during the development of new paddy genotypes.

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