Estimation of Phenotypic and Genotypic Correlation and Path Coefficients in Rainfed Upland Rice (*Oryza sativa L.*) Genotypes at Guraferda, Southwest Ethiopia

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Abstract

A field experiment was conducted with the objective of determining the magnitude of association between yield and yield component characters. Fifteen rainfed upland rice genotypes were evaluated in randomized complete block design in three replications for two consecutive years (2014 and 2015) in southwest Ethiopia. Correlation coefficient analysis of grain yield showed positive and significant association with days to 85% maturity and number of fertile tillers per plant at both phenotypic and genotypic levels. At phenotypic level, thousand seed weight displayed positive and significant correlation with grain yield, while at genotypic level, panicle length and plant height exhibited positive and significant relationships. Thus, these traits could play pivotal role in the development of high yielding rainfed upland rice genotypes. Separation of correlation coefficients into direct and indirect effects of component traits on grain yield revealed that days to 85% maturity and number of fertile tillers per plant exerted the maximum positive direct effect on grain yield at both genotypic and phenotypic levels. The direct contribution of days to 85% maturity supported indirectly by panicle length and thousand seed weight at phenotypic level. At genotypic level, panicle length assisted the direct contribution of days to 85% maturity to the grain yield. Therefore, while making selection these characters would be reliable criteria for improving grain yield of upland rice genotypes at south-western Ethiopia.

Keywords: Direct and indirect effect; Positive and negative correlation; Rice; Rainfed; Yield component traits

Introduction

Rice (*Oryza sativa L.* and *Oryza glaberrima Steud*) belongs to the family Poaceae, is the most significant food crops of the world and assists as a chief food basis for more than 50% of the world population [1]. It offers a wealth of material for genetic studies because of its wide ecological distribution and enormous variation encountered for various qualitative and quantitative characters. It is predominantly a

Character association studies have been done in upland rice genotypes in different parts of the country, however there has been no studies done by using currently used upland rice genotypes in southwest Ethiopia. The present study was conducted in order to determine the magnitude of association among component traits among themselves and with grain yield. In the view of above situations, correlation and path coefficient analysis of fifteen rainfed upland rice genotypes were studied for seven characters to evaluate the contribution of each trait towards grain yield.

Materials and Methods

Description of the experimental site, materials and procedures

The experiment was conducted at Guraferda in Bonga Agricultural Research Center experimental station for two consecutive years (2014 and 2015). The site is located at an altitude of 1235 meters above sea level, 7° 26' N and 36° 22' E latitude and longitude, respectively. It receives an annual rainfall of 1710 mm and mean monthly minimum and maximum temperature of 16.7°C and 24.0°C, respectively [15]. The experimental materials consisted of 15 rainfed upland rice genotypes (Advanced lines) obtained from Fogera National Rice Research and Training Center (FNRRTC) and Bonga Agricultural Research Center: *Hidassie* (WAB515-B-16A1-2), *Getachew* (AD01), *Andassa* (AD012), *Tana* (AD048), *NERICA-3*(WAB450-IB-P-28-HB), *SUPERICA-1*(WAB-4507), *Kokit* (IRAT-209), *NERICA-12*, *NERICA-13*, *NERICA-14*, *NERICA-15*, *NERICA-18*, *FOFIFA-4129*, *FOFIFA-3737*, *FOFIFA-3730* were used as experimental materials. The experiment was laid out in randomized complete block design in three replications. The spacing between replications, plots and rows was 1, 0.3 and 0.2 m, respectively. Seeds were drilled in rows with a rate of 60 kg per hectare. The gross and net harvestable plot size of the experiment were 6 m^2 (six rows of 5 m of long and 1.2 m wide) and 4 m^2 (four rows of 5 m long and 0.8 m wide), respectively, and four inner most central rows were used for data collection. Fertilizer was applied at a rate of 100 kg DAP and 100 kg Urea ha^{-1} . All DAP was applied during sowing whereas urea was applied in three equal splits at sowing, tillering and at panicle initiation stages. Weeding was done three times manually during the whole experimental period as required.

Data collection and analysis

Standard evaluation system developed by IRRI [16] was followed in order to collect yield and yield component data. Days to 50% heading and days to 85% maturity were computed on plot basis. Five representative plants for each genotype in each replication were randomly taken to record observations on plant height (cm), panicle length (cm), fertile or productive tillers per plant. Grain yield obtained on plot bases was converted into Kg ha^{-1} and adjusted to 14% grain moisture content.

Phenotypic and genotypic correction coefficient analysis

Phenotypic and genotypic correlation coefficients were computed from variance and covariance components based on the method described by Singh and Chaudhury [17]. The Pearson correlation test was applied for phenotypic and genotypic correlation coefficients respectively using SAS statistical package [18].

Phenotypic and genotypic path coefficient analysis

The direct and indirect effect of component traits on yield and among themselves were estimated following the method suggested by Dewey and Lu [19] given as follows.

$$r_{ij}=P_{ij}+\Sigma r_{ik}p_{kj}$$

Where: r_{ij}=Mutual association between the independent trait (i) and dependent trait (j) as measured by the correlation coefficient.

P_{ij}=Component of direct effects of the independent trait (i) on the dependent variable (j) as measured by the path coefficient and, $\Sigma r_{ik}p_{kj}$=Summation of components of indirect effect of a given

yield ha^{-1}. Presence of early heading genotypes is important for climate

T e path coe f cient analysis result revealed that, at phenotypic level,

of component traits on grain yield. Thus, days to 85% maturity and number of fertile tillers per plant exerted maximum positive direct effect on grain yield at both genotypic and phenotypic levels. The direct contribution of days to 85% maturity supported indirectly by panicle length and thousand seed weight at phenotypic level. At genotypic level, panicle length assisted the direct contribution of days to 85% maturity to the grain yield. Therefore, these characters would be reliable criteria for improving grain yield of upland rice at south-western Ethiopia.

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