Assessment of Correlation of Morphological,Panicleand Physiological Traitswith SeedYieldin Rice(*Oryzasativa*L.)

ABSTRACT

Thirty-six rice varieties were evaluated at the instructional farm, College ofAgriculture,IGKV,Raipur(C.G.)duringtheyear2021-22and2022-23underthe*Kharif*season.Thecorrelationstudieswithdifferentmorphological,panicle,andphysiologicaltraitswerecarriedoutandsuggestedthattraitsnumberoftillers,productive tiller, number of leaves, total dry weight, SCMR value of flag leaf, secondleaf, third leaf, net assimilation rate, specific leaf weight, light interception, Harvestindex, panicle weight plant^{-1}, total grain panicle^{-1}, fertile grains panicle^{-1}, number ofprimary branches panicle^{-1}, and number of fertile grains on primary branch contentwere positively correlated at $p<0.001$ significant level, while Flag leaf length, angle oftopthreeleaves,specificleafarea,sterilegrainspanicle^{-1},numberofsterilegrainsonprimary branch, and number of sterile grains on secondary branch were negativelyassociatedwithgrainyieldduring boththeyears.Hence,thesetraitscouldbeconsideredtheprincipaltraits.Thus,correlationanalysissuggestedthattheseparametersare indicatorsfor high-yieldingcultivars.

Keywords:-Rice,correlationanalysis,plantarchitecture,growthtrits,Yieldattributes.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important essential primary nutritivesource of food grain crops (Li *et al.,* 2021). It is consumed as food by more than 85%population in the world and 90% of Asia and it belongs to the grass family Poaceae(Kulendra *et al*., 2020 and Bagri *et al.,* 2022). It is also grown in 115 countries henceit is also known as "Global grain" (Singh *et al*., 2021). About 21 % of calories comefrom rice crops and it plays an essential role in global food security (Mohidem *et al.,*2022).

In rice leaf orientation patterns, leaves are main source of photosynthesis andit plays important role in crop growth and grain yield. Mostly the 42-45% flag leafcontribution in rice crop yield as compared to other leaves. (Mahesh *et al.,* 2022). Arelatively wide leaf angle and lower leaf orientation value will increase leaf shade anddecrease photosynthetic efficiency, whereas plants with a relatively narrow leaf angleand high leaf orientation value will display a plant architecture that is more efficient incapturing light for photosynthesis, improving grain filling, and increasing grain yield(Ku *etal.,*2010).

Paniclearchitectureisoneofthemostimportanttraitsrelatedtoricegrainyieldandaff ectscropproductivity.Paniclelengthstronglyaffectspaniclearchitecture.Thus,panicle length is a key factor determining the diversity of panicle architecture in rice(Agata *et al.,* 2020). Panicle branching patterns that are mainly regulated by thenumberofprimaryandsecondarybranchesdirectlydeterminethetotalgrainnumber.Ma ny high-yielding rice cultivars tend to have longer primary branches and producemore secondary branches than standard varieties. Therefore, panicle rachis lengthandprimarybranchlengthinfluencetotalgrainnumber,riceproductivity,andbranchi ngnumber (Mohapatra andSahu,1991).

Efforts are being made in the direction of breaking the yield barriers that arepresentinricebreedingschemes.Additionally,grainyieldisacomplicatedcharacteristic that is dependent on a large number of component characteristics *viz*.morphological, panicle, physiological and it does not react well to direct selection. Inorder to enhance grain yield, it will be beneficial to have knowledge regarding therelationship that exists between grain yield and the characteristics of its constituentparts.Forthisreason,thecurrentstudywascarriedoutinordertogainanunderst anding of the relationship between grain production and the characteristics ofitsconstituent parts.

MATERIALANDMETHODS

The thirty-two improved rice cultivars along with four local checks (MTU-1001,Rajeshwari, Swarna, and MTU-1010) i.e. the material used for the study consisted oftotal 36 improved rice cultivars under upland irrigated conditions, taken from IGKV,Raipur (C.G.) under the IRRI project. The experiment was conducted under irrigatedconditions at experimental field, and the laboratory analysis was conducted in theDepartmentofPlantPhysiology,CollegeofAgriculture,IndiraGandhiKrishiVishwavidyalaya, Krishak Nagar, Raipur (C.G.) during *Kharif* season 2021-22 and2022-2023. The experiment was laid in Randomized complete block design with tworeplications. The observations were recorded on different morphological; panicle andphysiologicaltraits.Thesetraitswerechosenfollowingthestandardevaluationsystemfor Rice (IRRI, 1996) and data was subjected to statistical analysis to estimate thecorrelationofphyllotaxyandpaniclearchitecturewithseedyieldinricecropaccordingto Searle (1961). Correlation coefficient analysis measures the mutual relationshipbetweenvariouscharactersatgenotypic(g),phenotypic(p),andenvironmentallevelswith the help of the formula suggested by Lerner (1958). The schedule of variousrecommendedculturaloperationswas carriedoutduringthe investigation.

RESULTANDDISCUSSION

Thecorrelationcoefficientservesasa statisticaltoolemployedtomeasurethemagnitude of the association among two or more variables. It plays a pivotal role inassessing the usefulness of the selection procedure. Consequently, correlation offersvaluableinsightsintotheextentoftherelationshipamongvariouscontributingtraits.

Associationofplantarchitecturewithseed yieldattributingtraits

The correlation analysis measured the joint relationship between various planttraits and determined the traits on which the selection can be made for improvementin yield under irrigated conditions. The correlations between seed yield and plantarchitecture traits such as number of tillers (NT), productive tiller (PT), number ofleaves (NL), days to 50% flowering (DFF), total dry weight (TDW), flag leaf length(FLL), flag leaf width (FLW), flag leaf area (FLA), leaf area (LA),plant height (PH)werecarriedoutandpresented inTable1.

During year both years, the correlation analysis exhibited that seed yield wassignificantlycorrelatedwithtraitsviz.,numberoftillers(0.695**),productivetiller

(0.591**), number of leaves (0.695**), and total dry weight (0.887**, 0.909**) withp<0.01significancelevelinapositivemanner,while;thetraitsflagleaflength(-0.55**)attheflowveringstagewerefoundnegativelyassociatedwith seedyield.

Mohanan and Pavithran (2007) found that the ideal number of tillers yieldedhigher economic yields. Grain yield in cereals can be raised by raising the harvestindex,biomassproduction,or bothYoshida (1981).

Makino*et.al*.(2022)alsoreportedthatflagleaflengthwasnegativelycorrelatedwithseedyieldinricecrop.Thisresultwasincloseagreementwithpresentstudy.

Associationofseedyieldwith phyllotaxyand growthtraits

Similarly, the correlation analysis was carried out between seed yield andgrowth characters (Table 2). The data suggested that the seed yield was positivelycorrelated with SCMR value of flag leaf, second leaf, third leaf (0.955**, 0.943**,0.941**respectively),netassimilationrate(NAR)(0.961**),specificleafweight(SLW)(0.898**), and light interception (LI) (926**) with p<0.01 significance level, whereas;anglesofflagleaf(FLA),secondleaf(SELA),andthirdleaf(TLA)(-0.916**,-0.853**,
-0.793** respectively), and specific leaf area (SLA) (-0.778**) were also found inassociationwith seedyield negatively.

Guru*etal*.(2017)Grainyield,SCMR,andCCI(chlorophyllcontentindex)havealldemonstratedamuchpositivecorrelationwithflagleafthickness.Higherchlorophyll content per unit area in thicker leaves could be the cause of this, leadingto better photosynthesis. Leaf photosynthesis in many crops was found to have astrongpositivecorrelationwithSLW,ameasureofleafthickness,accordingtoBowes*etal.*(1972).

Associationofseedyieldwithpaniclearchitecture traits

Similarly, the correlation analysis was carried out between seed yield andpenical architecture traits. The data suggested that the seed yield was positivelycorrelatedwithviz.,Harvestindex(HI)(0.899**),panicleweightplant^{-1}(PWP)(0.909**), total grain panicle^{-1} (TGP) (0.619**), fertile grains panicle^{-1} (FGP) (0.781**),numberofprimarybranchespanicle^{-1}(NPB)(0.643**),andnumberoffertilegrainsonprimarybranch(PBFG)(0.643**)withp<0.01significancelevel,while;thetraitssterilegrainspanicle^{-1}(SGP)(-

0.772**),numberofsterilegrainsonprimarybranch(PBSG)

(-0.872**), and number of sterile grains on secondary branch (SBSG) (-0.569**) werefoundinassociationwith seedyield innegative manner(Table3).

Asignificantpositivecorrelationbetweenthelengthofpaniclesandthequantityof tillers in rice cultivars was observed by Kumar (1992). grain yield in cereals can beraised by raising the harvest index, biomass production, or both Yoshida (1981).Gautam*etal.*(2023)investigated,thatbetweenthenumberofspikeletsandthelengt hof the secondary branches, there is no discernible correlation. Ashrafuzzaman*et al.*,(2009) reported that the correlation between grain yields and their component in ricelineswasnotedbyKonate*etal.*(2016).However,grainyieldperplantexhibitsastrongpos itivecorrelationwithstemweightandbiomass.Bothatthegenotypicandphenotypic levels, grain yield per plant/kernel weight was positively and significantlycorrelatedwithdaystomaturity(Habib*etal*.2005).Grainweight,grainlength/br eadthratio, and grain length are all positively correlated. Both phenotypic and genotypiclevels of correlation between panicle length were found to be positive and significant.Theseoutcomes werealso observedbyRamkrishnan*et al.*(2006).

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Table 1: Correlationstudyofplantarchitectureattributes oflong,medium,andshort-durationricevarieties.

	SYP	PH (F)	PH (M)	NT(F)	PT	NL	DFF	FLL	FLW	FA	LA	TDW(F)	TDW(M)
SYP	1												
PH (F)	-0.454*	1											
PH (M)	-0.456*	1**	1										
NT(F)	0.695**	-0.865**	-0.861**	1									
PT	0.591**	-0.866**	-0.863**	0.913**	1								
NL	0.695**	-0.865**	-0.861**	1**	0.913**	1							
DFF	-0.153	0.408	0.405	-0.419*	-0.424*	-0.419	1						
FLL	-0.55**	0.87**	0.866**	-0.941**	-0.873**	-0.941**	0.521*	1					
FLW	-0.161	0.852**	0.846**	-0.739**	-0.752**	-0.74**	0.505*	0.818**	1				
FA	-0.475*	0.904**	0.899**	-0.93**	-0.88**	-0.93**	0.528**	0.985**	0.903**	1			
LA	-0.061	0.792**	0.786**	-0.67**	-0.721**	-0.67**	0.547**	0.809**	0.925**	0.863**	1		
TDW(F)	0.887**	-0.274	-0.281	0.456*	0.401	0.456*	-0.029	-0.297	0.055	-0.226	0.147	1	
TDW(M)	0.909**	-0.277	-0.283	0.468*	0.412	0.468*	-0.046	-0.307	0.048	-0.236	0.145	0.996**	1

##** Correlation is significant at 0.001 level (two-tailed)##**Correlationissignificantat0.001level(two-tailed)

Table2:Correlationstudyofphyllotaxyandgrowthattributesoflong,medium,andshort-durationricevarieties.

	SYP	FLA	SELA	TLA	FSV	SSV	TSV	LAI	NAR	SLA	SLW	LI
SYP	1											
FLA	-0.916**	1										
SELA	-0.863**	0.974**	1									
TLA	-0.793**	0.937**	0.979**	1								
FSV	0.955**	-0.954**	-0.895**	-0.836**	1							
SSV	0.943**	-0.967**	-0.931**	-0.876**	0.98**	1						
TSV	0.941**	-0.968**	-0.933**	-0.878**	0.978**	0.999**	1					
LAI	-0.062	0.355	0.471*	0.599**	-0.175	-0.25	-0.253	1				
NAR	0.961**	-0.943**	-0.901**	-0.849**	0.959**	0.961**	0.962**	-0.155	1			
SLA	-0.778**	0.904**	0.947**	0.974**	-0.793**	-0.83**	-0.831**	0.604**	-0.827**	1		
SLW	0.898**	-0.976**	-0.974**	-0.957**	0.925**	0.948**	0.947**	-0.438*	0.928**	-0.95**	1	
LI	0.926**	-0.951**	-0.905**	-0.844**	0.972**	0.977**	0.977**	-0.22	0.937**	-0.792**	0.918**	1

##** Correlation is significant at 0.001 level (two-tailed)##**Correlationissignificantat0.001level(two-tailed)

Table3:Correlationstudyofpaniclearchitectureattributesoflong,medium,andshort-durationricevarieties.

	SYP	PL	PBL	SBL	NPB	NSB	GL	GW	L:BR	PBFG	PBSG	SBFG	SBSG	TGP	FGP	SGP	PWP	TW	HI
SYP	1																		
PL	0.025	1																	
PBL	-0.144	0.309	1																
SBL	-0.302	0.323	0.345	1															
NPB	0.643**	-0.216	-0.235	-0.217	1														
NSB	-0.075	-0.143	0.127	0.116	0.219	1													
GL	0.44*	0.23	0.11	-0.064	0.157	-0.014	1												
GW	0.285	0.502*	0.282	0.031	0.217	0.045	0.699**	1											
L:BR	-0.007	-0.513*	-0.304	-0.147	-0.13	-0.015	-0.091	-0.751**	1										
PBFG	0.684**	0.208	0.115	-0.08	0.396*	0.091	0.468*	0.486*	-0.274	1									
PBSG	-0.872**	-0.034	0.115	0.163	-0.538**	0.134	-0.344	-0.196	-0.007	-0.535**	1								
SBFG	0.286	0.188	0.414	0.047	0.063	0.224	0.111	0.099	-0.095	0.387	-0.149	1							
SBSG	-0.569**	0.116	-0.018	0.161	-0.216	0.183	-0.244	-0.042	-0.108	-0.319	0.617**	-0.312	1						
TGP	0.619**	0.012	0.004	-0.124	0.768**	0.314	0.325	0.441*	-0.3	0.824**	-0.389	0.315	-0.14	1					
FGP	0.781**	0.056	-0.012	-0.144	0.776**	0.209	0.389	0.448*	-0.271	0.883**	-0.624**	0.338	-0.319	0.96**	1				
SGP	-0.772**	-0.121	0.056	0.127	-0.277	0.276	-0.321	-0.145	-0.033	-0.461*	0.953**	-0.166	0.692**	-0.173	-0.441*	1			
PWP	0.909**	-0.102	-0.22	-0.247	0.752**	0.053	0.365	0.251	-0.01	0.674**	-0.758**	0.261	-0.468*	0.734**	0.837**	-0.604**	1		
TW	0.274	-0.287	0.128	0.027	0.187	0.011	0.469*	0.113	0.335*	0.181	-0.191	0.089	-0.028	0.195	0.205	-0.11	0.333	1	
HI	0.899**	-0.173	-0.268	-0.428*	0.678**	-0.019	0.297	0.116	0.107	0.498*	-0.788**	0.241	-0.574**	0.532**	0.674**	-0.674**	0.899**	0.316	1

##** Correlation is significant at 0.001 level (two-tailed)##**Correlationissignificantat0.001level(two-tailed)