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A Correlation Study between Univariate Parametric and Non-Parametric Statistical Analysis to Identify Stable and High Yield Genotype of Grain Wheat

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Abstract

Six parametric and Nine non-parameric methods carried out form 12 Genotyp yield of wheat throughout 20 variable Environments within the rain fed areas of Pakistan for the 12 months 2010-2011, developing seasons have been used to principal cause of analyzing GEI throughout 20 Environments. We study a few parametric and non-parametric measures were used for the evaluation balance and adoptability of the genotypes at extraordinary environments. And also we look at the correlation or interrelationship amongst these measures.

The a few parametric strategies have been used Shukla's balance variance, Francis and Kannenberg's coefficient of variance, superiority index Pi, Wricke's covalence, and environmental variance, while non parametric techniques had been also carried out protected four Huehn and Nassar balance measures, Thennarasu's 4 balance measures, Spearman's rank correlation and rank sum technique. The parametric measures result obtained by using wricke's ecovelance and shukla's measures show that perfect advantageous correlation having identical solid genotype G6 (6C016) whereas the risky genotype resulted had been G2 (DN-73), G5 (AZRC,2008_1). The superiority index result of stable genotype is G2 (DN-73). The CV and environmental variance almost confirmed the identical consequences. According to the others all non- parametric strategies revealed genotype G6 (6C016) among first 3 most stable genotype, whereas G5 (AZRC, 2008_1) And also G2 (DN-73) was determined to be the various ultimate 3 volatile genotype.

Keywords: Univariate Parametric, Non-Parametric Statistical Analysis, Stable and High Yield Genotype of Grain Wheat

INTRODUCTION:

In an agricultural research METs are by and large held in plant breeding for stability of genotypes through environment. For the plant breeding adopting and stability of genotypes is of a fantastic well worth, a genotypes is considered greater strong if variant in its manufacturing thru tested environment is very low and imply manufacturing from various surroundings is excessive. The overall performance of genotype is proven with the aid of the time period GEI (genotype environment interaction) through various environments; here interaction is used as a statistical term to country that X and Y (two elements) engage. If the effect of component X varies for various levels of factor Y and vice versa. The GEI performs a important role in manufacturing balance analyses. If genotype

surroundings interplay is absent in any look at the genotype balance might be equal as a result the beneficial genotype in a single surroundings would be first-rate and favourable for all environments universally. GEI can be cross and non-crossover which depends at the class of genotypes in diverse environments. Interaction is considered non crossover if categories of genotypes stay identical in all environments, if it becomes changed from one environment to some other is called crossover. Various parametric measures for stability might be used in this examine. Study carried out [1] in which introduced ecovalence ($\mathcal{W}_i^{2)}$) a parametric method) wherein each genotype squared out is effected with the aid of GEI.

Another look at carried out [2] on balance variances (σ_i^2) which may be used as a widespread to pick out genotype as this measure states the identical weight to stability and yield each which help the explanation easier for extensive yield and strong genotype. The advent of some other balance approach in which he said that the gap among the reaction of genotype and common of the whole mean thru the accustomed environments by means of having their suggest rectangular[3], this method changed into denoted by using p_i. Will awareness specially to find out the very stable genotype with a big production across the usa (Pakistan). In present day research few non parametric parameters. The study might additionally be used for stability cause. Like Four balance measures $NP_i^{(1)}, NP_i^{(2)}, NP_i^{(3)}, and, NP_i^{(4)}$, and four balance techniques $S_i^{(1)}, S_i^{(2)}, S_i^{(3)}, and, S_i^{(6)}$ [4, 5].One more non-parametric balance model is rank sum method which is apply RS_i [6]

MATERIALS AND METHODS:

Material

In our take a look at we used a few statistical analysis of the grain yield of twelve genotype and throughout twenty variable rain -fed environments of Pakistan for the year of 2010-2011.The facts were obtained by the (NUWYT) , which become based at manage at distinctive regions and exclusive area of the u . S .. The statistical measures uni-variate parametric , non-parametric turned into performed for wheat yield stability of 12 genotypes across 20 environments , which encompass G1 (NRL-051), G2 (DN-73), G3 (05FJ S3074), G4 (KT5), G5 (AZRC-2008-1), G6 (6CO16), G7 (NR-397), G8 (NR-381), G9 (NR-390), G10 (NR-391), G11 (NR-392), G12 (L-CHECK). These all genotyps were evolved with the aid of some plant breeders across some studies institutes of Pakistan.

METHODS

Parametric methods

Parametric methods mean the which base at a distribution, and these distribution base on some assumptions. In our study we use some parametric methods.

(CV) Co-efficient of variation

The co-efficient of variation was used first time for stability of genotype over different locations.

C.V Formula:

$$CV_i = \left(\sqrt{S_i^2} / \bar{x}_{i.}\right) \times$$

i =1, 2, ……. .. . …, g

(w_i^2) Wricke's ecovalence method

The ecovalence concept is described and changed into used for stability of GEI which were the contribution of each genotype to the genotype surroundings interaction sum of square [1].

$$w_i^2 = \sum_{i=1}^{n} \left(x_{ij} - \bar{x}_{i.} - \bar{x}_{.j} + \bar{x}_{..} \right)^2$$

where x_{ij} is the observed yield response (mean across experiment replicates), $\bar{x}_{i.}$ and $\bar{x}_{.j}$ correspond to previous mean notations,And $\bar{x}_{..}$ is the grand mean.

(P_i) superiority index

The superiority index is introduced first time P_i as known as show the superiority index [3]. p_i is define as the mean distance of squares b/w the response of the given genotype and the maximum response grand average over all locations.

(σ_i^2) Shukla stability variance

Shukla balance variance become proposed for the calculation of every genotype across all tested environments [2]. Stability variance based on error sum of square calculated form 2-manner suggest desk so as to G × E. The rank correlation coefficient b/w the ecovelence and balance variance is flawlessly tremendous (r=1) then the ranked of genotype in identical order.

(S_i^2) Environmental variance

The idea of environmental variance is simple and most effective technique of stability evaluation, here we just check if the small price of environmental variance is a solid genotype. It's miles denoted through s_i^2.

Non-Parameric methods

Non-parameric measurements are not primarily based on assumption of distribution or assumption at the parameters

which appropriate for normality and homogeneity of variance, non-parametric measures are appropriate for non-normal and heteroscedastic environments.

Non-parameric four measures of yield stability

These 4 balance measures are introduced [7, 8]. The 4 measures are preferred with manner mean approach in which genotype changed into use as rows and environments as columns, then we assigned yield Rank of genotype. Four non- parametric measures are denoted $S_i^{(1)}$,$S_i^{(2)}$,$S_i^{(3)}$,and $S_i^{(6)}$.

(RS_i) Kang's rank sum method

Rank sum measure is non-parametric technique introduced and it is denoted by RS_i. RS_imeasure is the mixture of stability variance [2]and the yield used to selecting a solid genotype. The ranks for yield and for variance are added, after which we take a look at the genotype which minimal rank sum is taken into consideration to most suitable genotype.

Thennarasu's four non-parametric measures

Suggested thennarasu's (1995) for four non parametric stability measuers to analysing the genotype stability of some crops. Which is denoted by $NP_i^{(1)}$,$NP_i^{(2)}$,$NP_i^{(3)}$,and ,$NP_i^{(4)}$.

The formulas:

$$NP_i^{(1)} = \frac{1}{m}\sum_{j=1}^{m}\left|r_{ij}^{*} - M_{di}^{*}\right|$$

$$NP_i^{(2)} = \frac{1}{m}\left[\sum_{j=1}^{m}\left|r_{ij}^{*} - M_{di}^{*}\right|/ M_{di}\right]$$

$$NP_i^{(3)} = \frac{\sqrt{\sum\left(r_{ij}^{*} - \bar{r}_{ij}^{*}\right)^2/m}}{\bar{r}_{i.}}$$

$NP_i^{(4)} = \frac{2}{m(m-1)} \left[\sum_{j=1}^{m-1} \sum_{j+1}^{m} \left|r_{ij}^* - r_{ij.}^*\right| / \bar{r}_{i.}\right]$

RESULTS AND DISCUSSIONS

In this observe 12 genotypes have been analyzed across 20 places by using various statistical methods either the univariate, multivariate and non parametrics guage the trade off inorder to findout the nearly all usable genotypes and further investigate the association between the specific locations and genotype. The statistical value observed throhgh various non parametric proven (desk 1) and the univariate parametric technique is proven (table 2) and (table three). We studied each parametric and non parametric balance strategies.

NON PARAMETRIC MEASURES OF STABILITY

In (table 1) the calculated values of the non parametric measures of the next nonparametric approach turned into delivered and called the (rank sum) technique of the balance. The approach manipulates the ranks of both (the steadiness and yield variances concurrently. Ranks have been provided to the mean yield of genotypes as well as their stability variance. Ranks to the yield were allocated from the highest to the lowest degree. It followes the rank 1 which turned to the high yielding genotype. All the ranks were executed within the identical sample. Ultimately the rank 12 converted into the allocated genotypes with the lowest yield while the ranks to shukla's stability variances have been assigned. In the same way rank one becomes the stated genotype with the bottom stability variance and so on. Eventually rank 12 converted into the genotype of high valued balance variance. The two carried

ranks of each genotype have been brought forward and the smallest (rank sum) genotypes was identified as stronger one. As per this approach the genotype having the smallest value would be the solid genotype. By observing the 20 genotypes the smallest rank sum got G7 observed G4 and G6, ultimately they have been considered the solid genotype through application of rank sum method, On the other hand due to the best rank sum G2 and G5 were considered the most risky one among the genotypes (table 1).

The table (1) Dark red values show high yield and most stable genotype' Dark yellow values show low yield and non-stable Genotype.

(Table 1): Nine Non Parametric stability method showing Genotype results

Code	$S_i^{(1)}$	$S_i^{(2)}$	$S_i^{(3)}$	$S_i^{(6)}$	$NP_i^{(1)}$	$NP_i^{(2)}$	$NP_i^{(3)}$	$NP_i^{(4)}$	Rsi
G1	0.005	11.923	34.31	8.996	3.05	0.488	0.536	0.001	10
G2	0.026	15.713	55.105	12.315	3.25	0.361	0.468	0.003	24
G3	0.01	14.063	32.835	8.512	3.3	0.6	0.632	0.001	13
G4	0.015	11.713	29.041	7.442	2.95	0.621	0.62	0.002	6
G5	0.01	15.694	49.049	12.127	3.3	0.366	0.445	0.001	22
G6	0.005	7.378	18.904	6.16	2.2	0.366	0.454	0	6
G7	0.031	13.936	16.831	5.191	3.1	0.775	0.887	0.007	4
G8	0.036	10.621	26	7.373	2.7	0.385	0.504	0.005	8
G9	0.057	12.515	48.122	12.244	2.9	0.341	0.425	0.007	15
G10	0.042	11.734	32.181	8.622	2.85	0.495	0.54	0.006	16
G11	0.026	13.207	37.297	9.26	2.95	0.453	0.538	0.004	16
G12	0.005	10.555	26.247	7.704	2.65	0.407	0.481	0.001	16

PARAMETRIC MEASURES OF STABILITY

The productivity of genotypes in the theory of imply yield across the environment (table 2) and the performance of tested genotypes showed a bit change, but no longer plenty of the genotypes were involved with in 20 environments. The mean production (yield) of 12 genotypes have been within C language (3056 forty three- 3587.28). There were 10 genotypes which

commonly suggested yield became an extra productive as compare to the mean yield of other genotypes. The genotype which was considered the highest productive of grain were taken into account of genotype G7 (3587.28), and the genotypes having the better common yield producer of grain were deemed as G4 and the genotype having lower yield of grain were considered as genotype G2 (3056,forty three). The lowest grain yielded genotype were termed as G5 (3062.59) in the same way G2 and G5 were observed as the two poorest genotypes among the 12 analysed genotypes within the theory of imply overall productive performance. All the examined environments [8] the degree of environmental variances aslo computed (table 2). The genotype G2 was considered the maximum one. This statistic quantitatively illustrated as biological stability which shows the genotype yield of bottom line in environmental change. The ultimate solid genotype within a little ental change were G10 and G3 which fall in second and third region of balance. Due to such approach the mean yield (production) of genotype G2 turned into under imply yield among all the genotypes, while the observed yield of genotype G3 produced a bit more than average yield, and the G10 become so near to the general yield imply (table 2). The three too strained genotypes having high fee of environmental change were considered to be G1 chased by using G8,9(table 2). Any how the most stronger genotypes with in the price of environmental change (116982852) and the highly risky genotypes with the price of environmental change (2143281.85) have been assessed by the sources of environmental balance approach [9]. Another best way for comparing the elements of genotypes cautioned is called the prevalence index, the extensiveness of any genotype may be evaluated by means of superiority index, Pi of the vascular plant can be estimated because the variances of genotypes with highest value in the vicinity is determined by taking the squire of variances then summing up the values and deviding them by

the help of two instances of the environment. The tracheophyte may be considered as the most solid and crystal source with a low cost of Pi among the genotypes tested in various places within the 20 environments. The genotype G2 having the lowest fee of superiority index is considered as maximum strong type of genotype (table 4 & 5) accompanied with the help of G7&12. The genotype containing the most important price of Pi may be the maximum strained tracheophyte genotype. The genotype G1 possessing the largest value of Pi deemed as unstable genotype with in all genotypes as well as G3&5 were the second and third region respectively. Further they specified the unstability of genotypes. The superiority approach may be effective by means of varities particularly in international experimental case, where the plenty of approaches are used. The shukla's independent balance variance is in consistent with parametric measures of stability. In lot of cases it is found that the level from shukla's degree of balance and ecovalence stability level are nearly same, because this stability variance is almost unbiased and capable to be utilized for greater comparison inorder to find out the genotypes balance. It may be applicable for unvailing the significance of genotypes which is testable through F test. In the study the genotype having the minimum chi square 2 proved as a maximum stable genotype G6 was found comparatively low variance genotype while the other low variance genotypes were G7&8. These three (G 6,7,8) genotypes were considered as strong genotypes among the others. The genotype possessing the high value of shukla's approach of stability is G2 proceeding through G 3 & 5 which were considered the highly risky genotypes in the study's observation (table 2).This method is mostly used for the determination of genotypes stability by isntaling it on the interactive consiquances of genotypes which produces the rate of every grower to GEI. Genotype having a minimun ecovalence mentions the minimal part of GE, which shows most strong

genotype, while in some genotypes $\mathcal{W}_i^2$ shows zero which is considered the most suitable solid genotype. A genotype having zero value of ecovalence proposes that its level order from environment to environment shows no change and its existance is not possible. In (table 2) the genotype G6 with a nominal cost of $\mathcal{W}_i^2$among the whole observed genotypes showed that G6 with low impact of GEI deemed the most stable genotypes. The genotypes G 7 & 8 with a great effect of GEI are considered unstable genotypes as well as G 2,3 & 5. It is an important to observe that ultimate outcomes were in consistent with shukla's stability variance..

(Table 2): showing Six parametric stability analysis result of 12 Genotypes

Code	Y	CV	$\mathcal{W}_i^2$	σ_i^2	Pi	$S_i^{(2)}$
G1	3359.4	43.6	2246582.6	128521.2	6051626.8	2143281.9
G2	3056.4	35.4	3798000.3	226505.5	1664713	1169828.5
G3	3366.4	38.9	2796343.5	163243	5779570.1	1713798.1
G4	3421.8	39.2	2104330.1	119536.8	3246632.1	1797144.9
G5	3062.6	44.9	3058039.3	179771.1	4922243.7	1886483.1
G6	3357.7	39.1	914422.43	44384.78	3721944.1	1726891.5
G7	3587.3	37.5	1677803.8	92598.34	2945120.2	1805759.9
G8	3354.1	43.3	1673472	92324.75	3599762.9	2108008.1
G9	3247.1	43	2180132.6	124324.4	3208335.8	1945634.9
G10	3317.1	39.1	2284016.9	130885.5	3109418.5	1683239.8
G11	3353.9	39.7	2791604	162943.6	3308241.4	1771903.8
G12	3328.5	40	2414823.2	139146.9	2350802.6	1769412.2

Here in table (2) Dark red values show high yield and most stable genotype' Dark yellow values show low yield and non-stable Genotype

(Table 2.1) Parametric stability analysis Correlation table

Correlation	Y	CV	$\mathcal{W}_i^2$	σ_i^2	Pi	$S_i^{(2)}$
Y	1					
CV	-0.189	1				
$\mathcal{W}_i^2$	-0.678	-0.157	1			
σ_i^2	-0.678	-0.157	0.999	1		
Pi	0.082	0.563	-0.083	-0.083	1	
$S_i^{(2)}$	0.384	0.828	-0.529	-0.529	0.572	1

BOTH PARAMETRIC AND NON-PARAMETRIC MEASURES

As per this degree G1,6 & 12 were having the same level and were considered the highly solid genotypes from 12 genotypes. The G 3 & 5 which were considered second and third maximum stable and strong genotypes. The genotype G1, 6 & 12 possessed the nominal modifications inside the rank beyond the environments with the assistance of G3. The genotype G 9 was considered the high volatile genotype including G 8 & 10 respectively. The $S_i^{(2)}$ determined on the basis of grade variance all over the environments of each genotype and the G 6 genotype stated the balance in all environments (table 2). Thennarasu's non-parametric records were also applied on this approach. (Table 1) shows the outcomes of the measure based on this method was computed by the help of rank mean of an adjusted production (yield). (Table 3) shows the rank information of the measure. The study contain four main techniques of Thennarasa's non-parametric record. As per first degree $NP_i^{(1)}$bottom value genotypes were computed with certain statistics containing the nominal ranks against the other genotypes were considered stable, hence the genotypes G 6, 8 & 12 were found stable, while the genotypes containing greater value among others weree considered unstable, therefor the genotypes G 2, 3 & 5 were volatile genotypes found unstable, anyhow G5 was considered the most unstable among

the other strained genotypes.The other two balance measures $NP_i^{(2)}$ & 3 were also determined and provided the almost same outcome of genotypes. Due to the fact the greater, lesser or equal ranking methods the results were approximately unfied. The $NP_i^{(2)}$(second statistic) was determined and stated that genotype G9 contained the bottom fee, therefor most strong genotypes were analysed and genotype G 2, 5 & 6 showed a lesser value of $NP_i^{(2)}$. The genotypes having greater values were dubbed as unstable genotypes. So the genotype G 2,5,6 & 9 containing greater value were considered unstable genotypes. As claimed by $NP_i^{(3)}$G 9 was turned the most crystal and solid genotype including the G 5 & 6, On the other hand G 3,4 & 7 were assesed and found the most risky genotypes.

(Table 3): Both non parametric and parametric ranks of 12 Genotypes in 20 Environments

Code	y	CV	W_i^2	σ_i^2	Pi	S_i^2	RS	$S_i^{(1)}$	$S_i^{(2)}$	$S_i^{(3)}$	$S_i^{(6)}$	$NP_i^{(1)}$	$NP_i^{(2)}$	$NP_i^{(3)}$	$NP_i^{(4)}$
G1	4	11	6	6	12	12	5	1	6	8	8	8	8	7	2
G2	12	1	12	12	1	1	12	7	12	12	12	10	2	4	7
G3	3	3	10	10	11	3	6	4	10	7	6	11	10	11	5
G4	2	6	4	4	6	7	2	6	4	5	4	6	11	10	6
G5	11	12	11	11	10	9	11	4	11	11	10	11	3	2	4
G6	5	5	1	1	9	4	2	1	1	2	2	1	3	3	1
G7	1	2	3	3	3	8	1	9	9	1	1	9	12	12	12
G8	6	10	2	2	8	11	4	10	3	3	3	3	5	6	9
G9	10	9	5	5	5	10	7	12	7	10	11	5	1	1	11
G10	9	4	7	7	4	2	8	11	5	6	7	4	9	9	10
G11	7	7	9	9	7	6	8	7	8	9	9	6	7	8	8
G12	8	8	8	8	2	5	8	1	2	4	5	2	6	5	2

CONCLUSION:

In this genotype throughout environments balance observe the mean yield of most and minimal common yield GEI turned into Genotype Highest average G7 (NR-397), lowest average G4 (KT-five) and Environment, biggest average E12 (ATTOK/BARS-Fateh jung), smallest average E10 (BAOUN/ARF). The Shukla's stability variance and ecovalence measures turned into almost equal result. Here the minimal

price of σ_i^2, $\mathcal{W}_i^2$ was solid genotype which as first G6-(6C016), second G8 (NR-381), third G7(NR-397) and the final strong genotype is G2-(DN-73), G5-(AZRC-2008-1) , G3-(05FJs3074), become ideal high quality correlation with ecovalence $\mathcal{W}_i^2$.

Superiority index Linn and Binns assign the end result of smallest price of solid genotype are G2 (DN-73), G12 (L-test) , and closing one is G7 (NR-397). Correlation b/w CV and $S_i^{(2)}$ turned into positively correlated. And different parametric measuers σ_i^2,and $\mathcal{W}_i^2$ were display the Low poor coerrlation.

Environmental variance recognized the maximum solid genotype amongst all 12 genotype were G2 (DN seventy three), G10 (NR 391 and G3 (05FJ-3074)) other un strong genotype turned into G1 (NRL Q517),G9 (NR 390). There is positive correlation between CV and $\mathcal{P}_i$ And negatively correlated with imply of yield , $(\mathcal{W}_i^{2)})$, (σ_i^2) , and $S_i^{(2)}$.

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