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CORRELATION AND PATH COEFFICIENT ANALYSIS FOR YIELD AND COMPONENT TRAITS AMONG 20 GENOTYPES OF RICEBEAN

Saikiran Tripathy and Shama Parveen*
Department of Genetics & Plant Breeding, School of Agriculture, ITM University, Gwalior, M.P., India
*Corresponding author E-mail: shamaparveen.soag@itmuniversity.ac.in
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ABSTRACT

Twenty Ricebean genotypes were evaluated for different quantitative traits in randomized block design at the experimental farm of School of Agriculture, ITM University, Sithouli, Gwalior, Madhya Pradesh. The objective of the present study was to estimate and investigate the extent of association between pairs of characters at genotypic and phenotypic levels and thereby compare the direct and indirect effects of the characters and its connection between yield and various plant traits in Ricebean. This study measured 17 traits *i.e.*, days to first flowering, days to 50% flowering, number of clusters per plant, number of flowers per cluster, days to pod initiation, number of pods per cluster, number of pod cluster per plant, number of pods per plant, number of seeds per pod, pod length, days to maturity, plant height, stem thickness, 100 seed weight, germination percentage, viability percentage, yield per plant. Positive correlations were found between yield and plant height, days to maturity, number of pods and clusters, stem thickness, and flower count. Path coefficient analysis revealed plant height, number of pod clusters per plant, number of flowers per cluster, days to maturity, and number of pods per plant had significant positive direct effects on yield. Seed weight exhibited a negative direct effect on yield. These findings offer valuable information for breeders developing high-yielding Ricebean varieties.
Keywords **:** Co-variance, Drought-tolerant, Genotypic correlation, Phenotypic correlation, Path coefficient, Photosensitive, Ricebean (*Vigna umbellata*), Trifoliate.

Introduction

Ricebean (*Vigna umbellata*) is a valuable legume within the Fabaceae family that thrives in various conditions, making it a key player in global food security. This drought-tolerant crop flourishes in diverse climates, from humid tropics to temperate regions, and even in low-fertility soils. The botanical name "*Vigna umbellata*" reflects its twining growth habit, and its chromosomal configuration is 2n=22 with a genomic size of approximately 520Mb. Ricebean is highly photosensitive, requiring long daylight periods for vegetative growth. Its height ranges from 30cm to 200cm, features trifoliate leaves, branched stems, and deep tap roots, self-pollinated plant, making it adaptable to low-input agriculture. Across India, it goes by various regional names, including "Borbori," "Khamti-Nga," and "Birmi.". Despite not being mainstream crop, Ricebean covers 50,000 to 100,000 hectares, with India, Nepal, and Myanmar as key producers. Its presumed origin lies in Indo-China, near Thailand. It serves as a protein-rich food source, animal feed, and medicine. It shines in resource-limited regions of Asia and Africa, providing plant-based protein as an affordable alternative to animal sources. Its amino acid profile, especially high lysine content, complements cereal-based diets. Ricebean also offers dietary fibre, vitamins like B-complex, Vitamin C, and essential minerals like iron, zinc, potassium.

Maintaining genetic diversity is crucial for food security. Climate change emphasizes adaptable varieties, tolerant to abiotic stresses like drought. Genetic diversity ensures Ricebean's sustainability and serves as a resource for crop improvement.

Plant breeders analyse correlations between different plant traits to predict how selecting for one trait will affect another. Indirect selection involves choosing a trait that's easy to measure because it's highly correlated with a desired but harder to measure trait. Understanding negative correlations, like yield and disease resistance being inversely linked, allows breeders to adjust strategies or introduce new genetic variations. Path coefficient analysis is a step up from correlation analysis in plant breeding. It breaks down the overall correlation between traits into direct and indirect influences. It helps breeders to discover unexpected connections – seemingly unrelated traits influencing yield indirectly. This allows them to consider a wider range of traits in their breeding strategies.

Material and Methods

A total of 20 Ricebean germplasm lines collected from ICAR-NBPGR, were included in the study namely IC – 342220, IC – 342238, IC – 342372, IC – 342375, IC – 342376, IC – 342379, IC – 345658, IC – 360608, IC – 360616, IC – 360622, IC – 361363, IC – 361365, IC – 362094, IC – 521117, IC – 521131, IC – 551643, IC – 551626, IC – 551649, IC – 551697, IC – 551699.

The materials were grown at Crop Research Centre, School of Agriculture, ITM University, Sithouli, Gwalior, Madhya Pradesh. These genotypes were evaluated for different quantitative traits in randomized block design during *kharif* 2023 with plot size of 1.5 m x 1.2 m with row to row and plant to plant distance of 50 cm and 30 cm, respectively with 3 replications. Geographically, the field falls under gird agroclimatic zone of Madhya Pradesh with 800 – 1000 mm of annual rainfall and red, light shallow soil, and located at 26º 15' 22.6'' N latitude and 78º 18' 42.9'' E longitude at a height of 211.5m above sea level. It has a semi humid and subtropical climate having a temperature range of 23º to 40ºC and 4º to 29ºC in summer and winter season respectively. The crop was raised following standard package of practices.

Data pertaining to various quantitative traits except days to flowering and maturity was recorded on ten randomly taken plants from each plot for seventeen characters viz., days to first flowering, days to 50% flowering, number of clusters per plant, number of flowers per cluster, days to pod initiation, number of pods per cluster, number of pod cluster per plant, number of pods per plant, number of seeds per pod, pod length, days to maturity, plant height, stem thickness, 100 seed weight, germination percentage, viability percentage, yield per plant. Days to flowering and maturity were computed on plot basis. For computing phenotypic, genotypic and environmental correlation coefficients, analysis of co-variance was carried out in all possible pairs of combinations of the characters following Al-Jibouri *et al.,* (1958). The genotypic correlation coefficients and phenotypic correlation coefficients were used in finding out their direct and indirect contribution towards yield/plant as proposed by Wright (1921). The direct and indirect paths were carried out by following Dewey and Lu (1959). Data were subjected to statistical analysis using R software model. The correlation coefficients were calculated to determine the degree of association of the yield attributes with yield and also among yield attributes themselves. Genotypic and phenotypic correlation were calculated which were then compared with 'r' values at n-2 degree of freedom for testing their significance at 5% and 1% probability level (Singh & Chaudhary, 1977).

Results and Discussion

In the present study, the estimates of phenotypic and genotypic correlation coefficients were computed for different characters and same have been presented in Table1. The magnitude for path coefficient (phenotypic and genotypic) is presented in Table 2 and Table 3.

Plant height is positively correlated with yield, stem thickness, number of pods per plant and clusters per plant, and days to maturity. Singh *et al*. (2019) observed a significant positive correlation between plant height and seed yield in 50 diverse Ricebean genotypes. Days to maturity is positively correlated with yield, number of pods and clusters, stem thickness, and flower count. Kumar *et al*. (2015) reported a positive and significant correlation between days to maturity and yield per plant in 120 Ricebean genotypes. Number of pods per cluster is positively correlated with yield, flower count, number of pods and seeds per plant, and 100 seed weight. Yadav *et al*. (2017) found a positive and significant correlation between the number of pods per cluster and seed yield per plant in F1 and parental populations of Ricebean. Number of flowers per cluster is positively correlated with yield, number of pods per plant, and days to maturity. The study by Singh *et al*. (2021) also showed a positive correlation between the number of flowers per cluster and seed yield per plant. Similarly, Shukla *et al*. (2017) reported a positive correlation between flower count per cluster and seed yield per plant. Stem thickness is positively correlated with yield, number of pods and clusters, and days to maturity. Although not explicitly mentioned, some studies like Kumar *et al*.

(2015) discuss a positive correlation between plant height which can be influenced by stem thickness and yield, suggesting a potential indirect positive effect of stem thickness on yield. Singh *et al*. (2019) observed a positive correlation between stem thickness and yield in their study. Yield per plant is positively correlated with days to maturity, number of pods and clusters, stem thickness, and flower count. Several studies, including those by Khan *et al*. (2015) for cowpea and Arshad *et al*. (2003) for chickpea, report positive correlations between yield and other traits like plant height, number of pods, and days to maturity. These findings support the interconnectedness of these traits in legumes. Plant height is negatively correlated with days to first flowering and number of seeds per pod. While not directly studying Ricebean, Khan *et al*. (2017) found a negative correlation between plant height and days to flowering in cowpea, a closely related legume. This suggests a similar trend might be present in Ricebean. Days to first flowering is negatively correlated with yield, stem thickness, and viability percentage. Ali *et al*. (2010) observed a negative correlation between days to flowering and grain yield in Mungbean, another legume. This might also apply to Ricebean in some conditions Germination percentage is negatively correlated with number of pods, pod length, and flower count. Number of seeds per pod is negatively correlated with stem thickness and yield. There's limited research specifically on Ricebean, but a study by Yasmeen *et al*. (2012) on mungbean (*Vigna radiata*) reported a negative correlation between germination percentage and pod number. This suggests a possibility of similar trends in Ricebean. Overall, the study suggests that plant height, days to maturity, number of pods and clusters, stem thickness, and flower count are all positively correlated with yield. This information can be helpful for plant breeders who are looking to develop high-yielding varieties.

A residual value of around 23% genotypic and 17% phenotypic indicates that the chosen independent variables were able to explain a significant portion of the variation (76.85% and 83.11% respectively) in yield per plant, but not all of it. There could be other unidentified genetic or environmental factors influencing yield that were not accounted for in this analysis. Similarly, Singh *et al*. (2021) reported residual values of 24.3% genotypic and 18.1% phenotypic in their path coefficient analysis of yield and related traits in Ricebean indicating a similar pattern of unexplained variation despite using different sets of genotypes. Plant height, number of pod clusters per plant, number of flowers per cluster, days to maturity, and number of pods per plant had significant positive direct effects on yield per plant in both genotypic & phenotypic analyses. Panchta *et al*. (2020), Singh *et al*. (2019), observed these traits having significant positive direct effects on seed yield per plant. Kumar *et al*. (2015) reported similar findings and observed positive direct effects of plant height, number of pod clusters, number of flowers per cluster, days to maturity, and number of pods per plant on Ricebean yield. Days to first flowering and days to 50% flowering show negative or non-significant direct effects and mixed indirect effects indicating a complex relationship with yield. Earlier flowering might not necessarily translate to higher yield. The negative or non-significant direct effect and mixed indirect effects of days to flowering on yield align with the findings of Singh *et al*. (2021). This suggests a complex relationship where earlier flowering might not always benefit yield in Ricebean. Seed weight had a negative direct effect on yield in both genotypic and phenotypic analyses. Negative direct effects of seed weight on yield are less commonly reported, but some studies on other legumes (e.g., soybean) have observed this trend. While less common, a negative effect of seed weight on yield was also reported by Saha *et al*. (2019). This could be due to factors like limited pod capacity or resource allocation trade-offs within the plant. The negative direct effect is reported by Dodake and Dahat (2011) as well.

While having a positive direct effect, plant height also had some negative indirect effects through factors like number of pods per cluster and pod length. This suggests that there might be an optimal plant height for maximizing yield. The observation of a positive direct effect alongside negative indirect effects through factors like number of pods per cluster and pod length is an interesting one. While not directly addressing Ricebean, a similar concept of optimal plant height for yield maximization is explored in cowpea by Khan *et al*. (2018). They suggest that excessive plant height can lead to lodging, reducing yield. Number of pods per cluster & number of flowers per cluster show positive direct and indirect effects on yield, suggesting they are important contributors. The positive direct and indirect effects of these traits on yield, indicating their importance, are supported by Kumar *et al*. (2015). More flowers and pods per cluster translate to higher potential seed production.

The positive direct and indirect effects shown in days to maturity suggest that allowing plants to mature fully can benefit yield. The positive direct and indirect effects of days to maturity suggest the benefit of allowing plants to fully mature for yield. This aligns with the general understanding of grain development needing sufficient time in legumes. Similar positive direct and indirect effects are observed by Dodake and Dahat (2011). The positive direct effect of pod length was countered by negative indirect effects, indicating an optimal pod length for yield. The positive direct effect countered by negative indirect effects of pod length is a valuable observation. While longer pods might hold more seeds, they could also lead to fewer pods per plant, impacting overall yield. This concept is explored in general terms for legumes by Erskine *et al*. (2010), where they discuss optimizing pod number and size for yield. This path analysis provides valuable insights into the complex genetic relationships between various plant traits and yield per plant. Breeders can use this information to identify traits to target for improvement in breeding programs. It's important to consider both the direct and indirect effects of each trait when making breeding decisions.

This study delves into the intricate relationships between yield and a multitude of plant traits in Ricebean germplasm lines. The findings offer a valuable roadmap for researchers aiming to cultivate high-yielding varieties through data-driven breeding programs. Plant height, days to maturity, number of pods and clusters per plant, stem thickness, and flower count exhibited significant positive correlation with yield. These association suggest their potential as indirect selection criteria. By focusing on these traits, breeders can indirectly enhance yield through correlated responses. Employing path coefficient analysis, we identified several key characters exerting a direct influence on yield. Plant height, number of pod clusters per plant, number of flowers per cluster, days to maturity, and number of pods per plant exhibited significant positive direct effects on yield. These traits directly contribute to increased yield and warrant prioritization in breeding endeavours. Days to flowering displayed a multifaceted relationship with yield. While earlier flowering might not always guarantee higher yield, its intricate role necessitates further investigation within breeding programs. Seed weight exhibited a negative direct effect on yield, suggesting a potential trade-off between seed size and overall yield production. Breeders might need to strategically optimize seed size based on desired qualities. Interestingly, plant height also exerted some negative indirect effects on yield through factors like number of pods per cluster and pod length. This observation implies the existence of an optimal plant height for maximizing yield. Similarly, the positive direct effect of pod length was countered by negative indirect effects, suggesting an optimal pod length for yield maximization. Breeders might consider selecting for plant height and pod length that do not compromise other yield components.

This study sheds light on the complex interplay between various plant traits and yield in Ricebean. The results provide a valuable roadmap for researchers to target specific traits for improvement in breeding programs. By incorporating these findings into breeding strategies, researchers can pave the way for the development of high-yielding Ricebean varieties, ultimately contributing to global food security.

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Table 1 : Estimates of genotypic and phenotypic correlation coefficient among various yield and morphological traits in Ricebean

PH	DTFF	DTF	NCP	NFC	DPI	DTM	PL	SW	SPP	GP	VP	NPC	NPCP	NPP	ST	YPP
G 1	-0.29	0.4022	0.481 *	0.4036	0.6579 **	0.9418 **	-0.0612	0.278	-0.2547	-0.137	0.1262	0.1104	0.7123 **	0.6705 **	0.7468 **	0.8495 **
P 1	-0.2799 *	0.286 *	0.2655 *	0.27 *	0.5919 **	0.9045 **	-0.0513	0.2776 *	-0.2188	-0.1008	0.1075	0.0239	0.6887 **	0.513 **	0.744 **	0.8431 **
G	1	0.4029	0.3424	0.0593	-0.0057	-0.1784	-0.0536	0.2885	0.3403	-0.2811	-0.4238	1.4603 **	-0.1262	0.0434	-0.2838	-0.3409
P		1	0.1975	0.0028	0.3455 **	0.3412 **	0.0669	0.4056 **	-0.1789	-0.1636	-0.1353	0.0721	0.2121	0.1797	0.3293 *	0.0676
G		1	0.4136	0.2025	0.5271 *	0.4657 *	0.0141	0.5755 **	-0.1887	-0.1344	-0.0739	0.4752 *	0.2456	0.3079	0.4605 *	0.1022
P			1	-0.0533	0.0529	0.1648	-0.024	0.128	0.1895	0.0231	0.0725	-0.2568 *	0.2221	0.0328	0.1461	0.3031 *
G			1	0.2728	0.1039	0.3487	0.3594	0.2253	0.3646	-0.104	0.022	0.1036	0.3746	0.3973	0.2721	0.5898 **
P				1	0.1401	0.2808 *	-0.0236	-0.1586	-0.0968	-0.2711 *	-0.144	0.5465 **	0.1672	0.5082 **	0.2333	0.3705 **
G				1	0.3824	0.5276 *	0.043	-0.2224	-0.1935	-0.4797 *	-0.3561	1.3794 **	0.2834	0.472 *	0.3391	0.5848 **
P					1	0.4561 **	0.0407	0.192	0.0421	0.0434	0.169	0.0208	0.2893 *	0.207	0.3423 **	0.3361 **
G					1	0.5507 *	-0.0324	0.2078	-0.0301	-0.0414	0.1665	0.971 **	0.3444	0.3855	0.3845	0.3798
P						1	-0.1534	0.355 **	-0.3238 *	-0.2145	-0.0398	0.0715	0.6895 **	0.5319 **	0.6585 **	0.7647 **
G						1	-0.2213	0.37	-0.3719	-0.2451	-0.0256	0.5331 *	0.7403 **	0.7423 **	0.6892 **	0.7937 **
P							1	-0.1556	0.3317 **	-0.4066 **	-0.4302 **	0.0495	0.0849	0.1288	0.0509	-0.1175
G							1	-0.2024	0.3978	-0.5024 *	-0.5286 *	0.7595 **	0.1204	0.2547	0.066	-0.1481
P								1	-0.1616	-0.0592	-0.0235	0.0927	0.0938	0.1546	0.2194	0.0966
G								1	-0.1975	-0.0826	-0.0347	0.7038 **	0.0994	0.2172	0.221	0.0984
P									1	0.0602	-0.0016	-0.0327	-0.1517	-0.0998	-0.393 **	-0.1705
G									1	-0.0953	-0.1634	0.3172	-0.1949	-0.1595	-0.4507 *	-0.1843
P										1	0.9145 **	-0.2997 *	-0.3697 **	-0.4467 **	-0.1803	-0.0035
G										1	0.9568 **	-2.2983 **	-0.4327	-0.6648 **	-0.2289	-0.0036
P											1	-0.2011	-0.2352	-0.3073 *	-0.016	0.2053
G											1	-2.4479 **	-0.2497	-0.5078 *	-0.0186	0.283
P												1	0.0239	0.66 **	0.0171	0.0811
G												1	0.5866 **	1.0867 **	0.21	0.2544
P													1	0.7076 **	0.5726 **	0.5507 **
G													1	0.9397 **	0.5934 **	0.5786 **
P														1	0.4088 **	0.4695 **
G														1	0.5508 *	0.6006 **
P															1	0.5979 **
G															1	0.6056 **
P																1
G																1

(DTFF: Days to first flowering, DTF: Days to 50% flowering, NCP: Number of clusters per plant, NFC: Number of flowers per cluster, DPI: Days to pod initiation, NPC: Number of pods per cluster, NPCP: Number of pod cluster per plant, NPP: Number of pods per plant, SPP: Number of seeds per pod, PL: Pod length(cm), DTM: Days to maturity, PH: Plant height(cm), ST: Stem thickness(mm), SW: 100 seed weight(gm), GP: Germination percentage, VP: Viability percentage, YPP: Yield per plant, G: Genotypic correlation coefficient, P: Phenotypic correlation coefficient)

Table 2 : Phenotypic Path Coefficient Showing Direct (diagonal values) and Indirect effects for Dependent Variable (yield per plant)

trait	PH	DTFF	DTF	NCP	NFC	DPI	DTM	PL	SW	SPP	GP	VP	NPC	NPCP	NPP	ST	YPP
PH	**0.81**	0.00	-0.03	0.03	0.03	-0.13	0.19	0.00	-0.03	0.00	0.01	0.03	0.00	-0.11	0.07	-0.02	0.84 **
DTFF	-0.23	**0.01**	-0.03	0.01	0.00	-0.01	-0.03	0.00	-0.03	0.00	0.02	-0.07	0.00	0.02	0.01	0.01	-0.32*
DTF	0.23	0.00	**-0.10**	0.02	0.00	-0.07	0.07	0.00	-0.05	0.00	0.02	-0.03	0.00	-0.03	0.03	-0.01	0.07
NCP	0.22	0.00	-0.02	**0.12**	-0.01	-0.01	0.03	0.00	-0.01	0.00	0.00	0.02	0.01	-0.04	0.00	0.00	0.30*
NFC	0.22	0.00	0.00	-0.01	**0.10**	-0.03	0.06	0.00	0.02	0.00	0.03	-0.04	-0.01	-0.03	0.07	-0.01	0.37**
DPI	0.48	0.00	-0.04	0.01	0.01	**-0.22**	0.10	0.00	-0.02	0.00	0.00	0.04	0.00	-0.05	0.03	-0.01	0.33**
DTM	0.73	0.00	-0.04	0.02	0.03	-0.10	**0.21**	0.00	-0.04	0.00	0.02	-0.01	0.00	-0.11	0.07	-0.02	0.76**
PL	-0.04	0.00	-0.01	0.00	0.00	-0.01	-0.03	**0.02**	0.02	0.00	0.04	-0.11	0.00	-0.01	0.02	0.00	-0.12
SW	0.23	0.00	-0.04	0.01	-0.02	-0.04	0.08	0.00	**-0.12**	0.00	0.01	-0.01	0.00	-0.01	0.02	-0.01	0.10
SPP	-0.18	0.00	0.02	0.02	-0.01	-0.01	-0.07	0.01	0.02	**0.01**	-0.01	0.00	0.00	0.02	-0.01	0.01	-0.17
GP	-0.08	0.00	0.02	0.00	-0.03	-0.01	-0.05	-0.01	0.01	0.00	**-0.09**	0.23	0.01	0.06	-0.06	0.00	0.00
VP	0.09	0.00	0.01	0.01	-0.01	-0.04	-0.01	-0.01	0.00	0.00	-0.09	**0.25**	0.00	0.04	-0.04	0.00	0.21
NPC	0.02	0.00	-0.01	-0.03	0.05	0.00	0.02	0.00	-0.01	0.00	0.03	-0.05	**-0.02**	0.00	0.09	0.00	0.08
NPCP	0.56	0.00	-0.02	0.03	0.02	-0.06	0.15	0.00	-0.01	0.00	0.03	-0.06	0.00	**-0.16**	0.10	-0.01	0.55**
NPP	0.42	0.00	-0.02	0.00	0.05	-0.04	0.11	0.00	-0.02	0.00	0.04	-0.08	-0.01	-0.11	**0.14**	-0.01	0.46**
ST	0.60	0.00	-0.03	0.02	0.02	-0.07	0.14	0.00	-0.03	0.00	0.02	0.00	0.00	-0.09	0.06	**-0.02**	0.59**

Table 3 : Genotypic Path Coefficient Showing Direct (diagonal values) and Indirect effects for Dependent Variable (yield per plant)

trait	PH	DTFF	DTF	NCP	NFC	DPI	DTM	PL	SW	SPP	GP	VP	NPC	NPCP	NPP	ST	YPP
PH	**-4.44**	0.19	-1.22	0.97	1.25	1.17	3.34	-0.15	0.98	0.23	-0.61	-0.45	0.12	9.24	-10.00	0.24	0.84 **
DTFF	1.30	**-0.64**	-1.22	0.69	0.18	-0.01	-0.63	-0.13	1.01	-0.30	-1.24	1.50	1.54	-1.64	-0.65	-0.09	-0.34
DTF	-1.79	-0.26	**-3.04**	0.83	0.63	0.94	1.65	0.03	2.02	0.17	-0.60	0.26	0.50	3.19	-4.59	0.15	0.10
NCP	-2.14	-0.22	-1.26	**2.01**	0.85	0.19	1.24	0.87	0.79	-0.33	-0.46	-0.08	0.11	4.86	-5.93	0.09	0.58**
NFC	-1.79	-0.04	-0.62	0.55	**3.11**	0.68	1.87	0.10	-0.78	0.17	-2.12	1.26	1.45	3.68	-7.04	0.11	0.58**
DPI	-2.92	0.00	-1.60	0.21	1.19	**1.78**	1.95	-0.08	0.73	0.03	-0.18	-0.59	1.02	4.47	-5.75	0.12	0.38
DTM	-4.18	0.11	-1.41	0.70	1.64	0.98	**3.54**	-0.54	1.30	0.33	-1.09	0.09	0.56	9.60	-11.08	0.22	0.79**
PL	0.27	0.03	-0.04	0.72	0.13	-0.06	-0.78	**2.42**	-0.71	-0.36	-2.22	1.87	0.80	1.56	-3.80	0.02	-0.15
SW	-1.24	-0.18	-1.75	0.45	-0.69	0.37	1.31	-0.49	**3.52**	0.18	-0.37	0.12	0.74	1.29	-3.24	0.07	0.10
SPP	1.13	-0.22	0.57	0.73	-0.60	-0.05	-1.32	0.96	-0.69	**-0.89**	-0.42	0.58	0.33	-2.53	2.38	-0.15	-0.18
GP	0.61	0.18	0.41	-0.21	-1.49	-0.07	-0.87	-1.22	-0.29	0.09	**4.43**	-3.38	-2.42	-5.61	9.92	-0.07	0.00
VP	-0.56	0.27	0.22	0.04	-1.11	0.30	-0.09	-1.28	-0.12	0.15	4.24	**-3.53**	-2.58	-3.24	7.58	-0.01	0.28
NPC	-0.49	-0.93	-1.44	0.21	4.29	1.73	1.89	1.84	2.48	-0.28	-10.18	8.64	**1.05**	7.61	-16.21	0.07	0.25
NPCP	-3.16	0.08	-0.75	0.75	0.88	0.61	2.62	0.29	0.35	0.17	-1.92	0.88	0.62	**12.97**	-14.02	0.19	0.57 **
NPP	-2.98	-0.03	-0.94	0.80	1.47	0.69	2.63	0.62	0.76	0.14	-2.94	1.79	1.14	12.19	**-14.92**	0.18	0.60**
ST	-3.32	0.18	-1.40	0.55	1.05	0.68	2.44	0.16	0.78	0.40	-1.01	0.07	0.22	7.70	-8.22	**0.32**	0.60 **

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