ZIBELINE INTERNATIONAL™ PUBLISHING

Science Heritage Journal (GWS)

DOI: http://doi.org/10.26480/gws.02.2022.37.39

ISSN: 2521-0858 (Print)
ISSN: 2521-0866 (Online)
CODEN: SHJCAS

REVIEW ARTICLE

CORRELATION AND PATH COEFFICIENT ANALYSIS OF YIELD IN WHEAT

Pooja Mandal

Department of Genetics and Plant Breeding, Institute of Agriculture and Animal Science (IAAS), TU Kritipur.
****Corresponding Author Email: puzamandal14@gmail.com***

ARTICLE DETAILS

Article History:

Received 04 June 2023
Revised 08 August 2023
Accepted 20 September 2023
Available online 21 September 2023

ABSTRACT

The third-most important food crop in Nepal after rice and maize is wheat, widely known as the "king of cereals" and the most important food crop in the entire globe. The actions and combinations of several direct and indirect features lead to grain yield. While path coefficient analysis identifies direct and indirect effects of one variable on another and analyses cause-and-effect linkages among the characteristics, correlation coefficient is a measure of the degree of association between yield and yield attributing components. Plant breeders employ both correlation and path analysis to help them find qualities that may be used as selection criteria to increase crop output. In a number of investigations, earlier researchers measured relationships between yield and yield-attributing characteristics. This study was conducted with the intention of reviewing a few such studies on the correlation and path coefficient analysis of wheat production conducted by other researchers. The number of grains per spike, the length of the spike, the biomass yield, the harvest index, the number of spikes per square metre, the effective tiller, the weight of a thousand grains, the height of the plant, etc. all had a positive direct impact on the yield, whereas the days until flowering, the days until booting, and the days until heading had a positive indirect impact. The maximum negative direct impact shown by chlorophyll concentration on grain yield. The features to be chosen for the hybridization programme should have a direct and positive impact on the yield.

KEYWORDS

Correlation, Path Coefficient Analysis, Wheat, Yield

1. INTRODUCTION

For 35% of the world's population, wheat is a staple grain that contributes more calories and proteins (niacin, thiamin) to the diet than any other cereal. Compared to other cereals, its kernel has a higher concentration of gluten protein, which makes it particularly feasible to generate a variety of end products (CIMMYT, 2002). Until 2050, the demand for wheat is expected to increase by 60 % than in the present year (FAOSTAT, 2022). With a yield of 760 million tonnes, it is cultivated on around 220 million hectares worldwide (FAOSTAT, 2022). According to (USDA, 2022) the average yield of wheat in the world is 3.58 t/ha. In Nepal, wheat is the third most important staple food crop after rice and maize with area, production, and productivity of 711,067 ha, 2,127,276 t and 2.98 t/ha, respectively (MoALD, 2021). This output is far lower than that of the majority of the world's producers of wheat and is unable to meet Nepal's expanding population's needs. The primary focus of wheat breeders has been on increasing grain production and creating varieties that are high yielding and adaptable to a variety of environments in order to reduce the current yield gap and promote food security in developing nations like Nepal (Ayer et al., 2017).

The actions and interactions of many traits result in grain yield. Direct contributing traits include the number of effective tillers per unit area, the number of fertile panicles per unit area, and the 1000-grain weight. Indirect contributing traits include the height of the plant, the length of the panicle, the length of the seed, the rate of seed germination, and others (Huang et al., 2013). In most cases, correlation analysis is used to establish the link between yield and its many component qualities, although correlation by itself is unable to show the full association of traits with yield owing to relationships among component traits. Path coefficient is one of the most effective methods for analysing the kind, scope, and direction of selection. It is used to pinpoint accurate cause-and-effect linkages and to distinguish between direct, indirect, and combined (direct and indirect) causal effects. Future breeding programmes based on trait selection can be made more efficient through the use of correlation and path coefficient analyses (Kandel et al., 2017).

2. DISCUSSION AND ARGUMENT

Biomass yield, harvest index, thousand kernel weight, flag leaf area, number of grains per spike, and plant height all have positive and significant correlations with grain yield. Grain yield showed negative and significant associations with days to flowering, days to heading, and days to booting. Following harvest index, number of roots, number of grains per spike, and number of tillers per square meter, path analysis showed that biomass weight had the maximum positive direct effect on grain yield (Khanal et al., 2020). Traits like Days to booting, Days to heading, Days to maturity, Chlorophyll leaf content, Plant height, and Number of grains per spike have been found to have a non-significant positive correlation with grain yield under heat stress. There is a highly significant positive correlation between Effective Tiller/m and Grain Yield. However, there is no statistically significant negative correlation between grain yield and spike length, spike weight, or thousand kernel weight. Days to heading, Spike length, Chlorophyll leaf content, and Number of grains per spike all have an indirect effect on GY in path analysis, while Days to maturity and Effective tiller/m2 have a positive direct effect on grain yield (Jaisi et al., 2021).

The key to wheat's ability to adapt globally is its exceptional genetic capacity to synchronize its flowering time with favorable conditions. This permits wheat plants to yield a satisfactory amount of grain under a wide range of soil moisture and temperature conditions. (Kamran et al., 2014).

Quick Response Code	Access this article online	
	Website: www.jscienceheritage.com	**DOI:** 10.26480/gws.02.2022.37.39

Cite The Article: Pooja Mandal (2022). Correlation and Path Coefficient Analysis of Yield in Wheat. *Science Heritage Journal, 6(2): 37-39.*

The number of efficient tillers is highly significant and positively correlated with grain yield. Tillers are formed in a specific development. Those tillers formed at later stages may die prematurely. Due to their competition for nutrients and assimilates, these tillers and the non-reproductive tillers may have negative effects (Langer and Dougherty, 1976). Because the final yield depends mainly on the number of tillers bearing spike per unit area, productive tillers are one of the key yield-attributing components (Pandey et al., 2017). Under normal conditions, spike weight (SW) showed a positive correlation and highly positive direct effect on GY at the gene level and weight of grain per spike (WGPS) at the phenotypic level. Also, under heat stress conditions, SW showed a positive correlation and a highly positive direct effect on GY. On the other hand, at the phenotypic level, WGPS and PH showed highly positive direct effects on grain yield (Poudel et al., 2021).

Positive and highly significant correlation (significance level 1%) showed between grain yield and biological yield, followed by harvest index, plant height, and 1000-grain weight at flowering. A significant positive association (at the 5% significance level) was also found between grain yield and grain per spike, followed by flag leaf area. Path analysis showed that biological yield and harvest index had the highest direct positive effect on grain yield. On the other hand, other traits contribute significantly to grain yield indirectly through biological yield and harvest index (Ayer et al., 2017).

There was a significant positive correlation between grain yield and panicle number/m2. A positive phenotypic correlation was also found between grain yield and Plant height, ear weight, ear length, ear number, ear length, thousand-grain weight. Analysis of path coefficients revealed that the magnitude of positive direct effects on grain yield was highest by panicle number/m2, panicle weight, number of grains per panicle, days to flowering, and 1000-grain weight (Ojha et al., 2018). Wheat grain yield has significant and positive genotypic and phenotypic correlation with ear counts per meter, grains per ear, grain weight per ear, 1000-grain weight, ripening days, aboveground mass yield and wheat harvest index. Path coefficient analysis of genotype correlations showed high positive direct effects of plant height, aboveground biomass, panicle length and harvest index on wheat grain yield (Upadhyay, 2020).

The grain yield of wheat showed significant association with biomass and a significant association between the numbers of productive tillers, thousand grain weight (TW), and harvest index. The highest positive effect on yield by biomass and harvest index was revealed by path coefficient analysis. (Kandel et al., 2017). A significant positive association between plant height and grain yield was observed. Highly significant negative association between chlorophyll and grain production was found. The largest positive direct effects on grain yield were shown by the number of spikes per meter and plant height, whereas the maximum negative direct effects were shown by the chlorophyll content and the number of days until heading and number of days until anthesis showed positive indirect effect on grain yield (Thapa et al., 2022).

Grain weight per spike and yield per plot were highly significantly positively correlated with the number of grains per spike (Ojha et al., 2019). For grain yield, the highest correlations between yield determinants and number of grains per spike were observed in the irrigated environment, whereas this correlated best with the number of spikelet per spike and spikelet length in the rainfed environment. In both environments, spike length had the maximum direct effect on grain yield and spikelet length and spikelet per spike have a direct positive effect on grain yield (Bhattarai Kushal, 2022).

3. Conclusion

Numerous yield-attributing traits affect wheat grain yield. Both a positive and a negative association between grain yield and certain yield-attributing features exists. We need to understand how various traits behave and how they relate to one another when choosing a wheat genotype. In the future, qualities that directly affect plant performance and features that are positively correlated should be chosen.

Acknowledgement

I would want to show my appreciation to everyone who helped finish this review article. I want to thank the professors and advisor first whose work served as the foundation for the manuscript. Their insights and dedication have immensely contributed to the field of study. I am also grateful for the guidance and support provided by seniors throughout the research process. Their knowledge and suggestions have been invaluable in shaping the direction and content of this article. Additionally, I extend our appreciation to the individuals who participated in discussions, shared their perspectives, and provided helpful suggestions during the peer review process. Your input has undoubtedly improved the quality and accuracy of this work. At last, I would like to sincerely thank my family, friends, and other loved ones for their unflagging encouragement, endurance, and comprehension during the writing process.

References

Ayer, D., Sharma, A., Ojha, B., Paudel, A., and Dhakal, K., 2017. Correlation and path coefficient analysis in advanced wheat genotypes. SAARC Journal of Agriculture, 15 (1), Pp. 1–12. https://doi.org/10.3329/sja.v15i1.33155

Bhattarai, K.B.B., and P.M., 2022. Correlation and path analysis of yield and yield attributing traits of wheat (Triticum aestivum) in irrigated and non-irrigated environments. 23 (3), Pp. 529–536. https://gauravpublications.com/journal/research-on-crops/volume-23/issue-3-september/ROC-868

CIMMYT. 2002. Guide to bread wheat breeding at CIMMYT. Wheat Special Report No.5 (Revised edition). 5, Pp. 58.

FAOSTAT. 2022. FAOSTAT. In World Food and Agriculture – Statistical Yearbook 2022. https://doi.org/10.4060/cc2211en

Huang, B., Yang, Y., Luo, T., Wu, S., Du, X., Cai, D., Loo, E. N. van, and Huang, B., 2013. Correlation, Regression and Path Analyses of Seed Yield Components in <i>Crambe abyssinica</i>, a Promising Industrial Oil Crop. American Journal of Plant Sciences, 04 (01), Pp. 42–47. https://doi.org/10.4236/ajps.2013.41007

Jaisi, S., Thapa, A., and Poudel, M.R., 2021. Relationship between Wheat Yield and Yield Attributing Character at Late Sowing Condition. Indonesian Journal of Agricultural Research, 4 (2), Pp. 142–155. https://doi.org/10.32734/injar.v4i2.6405

Kandel, M., Bastola, A., Sapkota, P., Chaudhary, O., Dhakal, P., and Chalise, P., 2017. Association and Path Coefficient Analysis of Grain Yield and Its Attributing Traits in Different Genotypes of Wheat (Triticum aestivum L.). International Journal of Applied Sciences and Biotechnology, 5 (4), Pp. 449–453. https://doi.org/10.3126/ijasbt.v5i4.18769

Khanal, D., Thapa, D.B., Dhakal, K.H., Pandey, M.P., and Kandel, B.P., 2020. Correlation and Path Coefficient Analysis of Elite Spring Wheat Lines Developed for High Temperature Tolerance. Environment & Ecosystem Science, 4 (2), Pp. 73–76. https://doi.org/10.26480/ees.02.2020.73.76

MoALD, 2021. Statistical Information On Nepalese Agriculture (2077/78). Publicatons of the Nepal in Data Portal, 73, Pp. 274. https://nepalindata.com/resource/statistical-information-nepalese-agriculture-207374-201617/

Ojha, B.R., Ojha, A., and Chaudhary, R., 2019. Variability, heritability and correlation studies on grain yield and related traits in spring wheat genotypes. 3(April), Pp. 57–62.

Ojha, R., Sarkar, A., Aryal, A., and Tiwari, S., 2018. Correlation and path coefficient analysis of wheat (Triticum aestivum L.) genotypes. Farming & Management, 3 (2). https://doi.org/10.31830/2456-8724.2018.0002.19

Poudel, M.R., Poudel, P.B., Puri, R.R., and Paudel, H.K., 2021. Variability, Correlation and Path Coefficient Analysis for Agro-morphological Traits in Wheat Genotypes (Triticum aestivum L.) under Normal and Heat Stress Conditions. International Journal of Applied Sciences and Biotechnology, 9 (1), Pp. 65–74. https://doi.org/10.3126/ijasbt.v9i1.35985

Thapa, A., Jaisi, S., and Poudel, M.R., 2022. Genetic variability and association among yield and yield components of wheat

genotypes (Triticum Aestivum L.). Big Data In Agriculture, 4 (1), Pp. 01–07. https://doi.org/10.26480/bda.01.2022.01.07

Upadhyay, K., 2020. Correlation and path coefficient analysis among yield and yield attributing traits of wheat (Triticum aestivum L.) genotypes. Archives of Agriculture and Environmental Science, 5 (2), Pp. 196–199. https://doi.org/10.26832/24566632.2020.0502017

USDA. 2022. World agricultural production. Ekonomika APK, 7, Pp. 59–65. https://doi.org/10.32317/2221-1055.201907059