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Correlation Coefficient (r) Values of Growth and Yield Components of Wheat under Different Nitrogen Levels and Placements

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Abstract: The field experiment was conducted at Student's Experimental Farm, Sindh Agriculture University, Tandojam to observe the correlation coefficient values of growth and yield traits of Kiran-95 wheat variety under different nitrogen levels and placements. Three nitrogen levels (80, 120 and 150 kg ha⁻¹) were incorporated through broadcast, band application, pop-up and foliar application. It was observed that a unit increase in wheat grain yield was positively associated with plant height ($r = 0.431$), productive tillers ($r = 0.419$), spike length ($r = 0.757$), grains spike⁻¹ ($r = 0.860$), seed index ($r = 0.878$) and harvesting index ($r = 0.949$). However, the grain yield showed non-significant and negative association with flowering days ($r = -0.146$) and maturity days ($r = -0.054$). It was concluded that correlation coefficient values should be determined for observing the degree of relationship of plant traits with yield to ensure that these parameters significantly contribute or not and positive contributing traits must be treated under intensive care to achieve yield targets.

Key words: Wheat, growth, yield, correlation, nitrogen, placements

INTRODUCTION

Wheat *Triticum aestivum* is an important cereal crop and staple food for most of the world's population. In Pakistan, wheat is grown on an area of 8463.0 thousand hectares having the average yield of 2499 kg ha⁻¹[1], which is very low as compared to other wheat producing countries such as, India, U.S.A. and China. There are many factors responsible for yield decrease, among those; fertilizer management is considered the major one. Much research has been done on the use of nitrogen fertilizer as broadcast as farmer practice but less attention is given to explore the other N placement methods for wheat. Nitrogen broadcast method is the incorporation of fertilizer on the surface of soil, which causes volatilization and the plant roots utilize less. Volatilization losses would be expected to be most severe under conditions of high evaporation, high soil pH and where large amounts of residue are on the soil surface. Under these conditions, ammonium nitrate is the preferred nitrogen source to use as top dressing. Potentially, Urea can lose large amounts of nitrogen therefore, nitrogen fertilizers should be incorporated into the soil when ever possible[2]. Carefoot *et al.*[3] reported that difference in grain and N derived from fertilizer were related to immobilization of broadcast ammonium nitrate. This depends on the degree of contact between the fertilizer, crop residue and soil moisture levels. Lower recovery of fertilizer N has been

attributed to immobilization of N with surface application of fertilizer[4]. It has been also reported that the method of placement has significant effect on the efficiency of nitrogen fertilizer by increasing the yield. In Alberta, barley yields increased when N fertilizer was banded[5] and net returns were also greater to the producer[6]. Banded fertilizer stimulated plant growth early in the growing season with increased plant N and P concentration. Wheat is much responsive to split nitrogen application by significant increase in plant height, tiller production, ear head size, seed index, which in-turn had positive effect on the production of grain and straw yields[7]. Looking the economic importance of the crop, the research was conducted to assess the degree of relationship of various crop parameters with yield under different N levels and placements.

MATERIALS AND METHODS

The study on Kiran-95 was conducted to determine the degree of relationship of growth and yield parameters of wheat under different nitrogen levels and placements at Student Experimental Farm, Sindh Agriculture University, Tandojam, Pakistan. Three nitrogen levels i.e. 80, 120 and 150 kg ha⁻¹ were tested through different placements (broadcast, banding, pop-up and foliar) in randomized complete block design. The observed parameters were analyzed for determination of correlation

coefficient values (r) though computer MSTATC statistical package.

RESULTS AND DISCUSSION

The plant height denotes the tallness and dwarfness of the crop. The plant height of the crop was positively associated with tillers plant⁻¹ ($r = 0.508$), spike length (cm) ($r = 0.493$), grains spike⁻¹ ($r = 0.442$), seed index ($r = 0.287$), harvest index ($r = 0.319$) and grain yield ($r = 0.431$), however, the plant height showed non-significant relationship with flowering days ($r = 0.084$) and negative non-significant relationship with days to maturity ($r = -0.037$). The number of tillers plant⁻¹ were significantly and positively associated with spike length ($r = 0.418$), number of grains spike⁻¹ ($r = 0.471$), seed index ($r = 0.356$), harvest index ($r = 0.333$) and grain yield ($r = 0.419$), whereas, the number of tillers plant⁻¹ showed non-significant relationship with flowering days ($r = 0.015$) and negative non-significant relationship with days to maturity ($r = -0.010$). The days to flowering were positively and significantly associated with number of grains spike⁻¹ ($r = 0.299$), seed index ($r = 0.3168$), harvest index ($r = 0.227$) and grain yield ($r = 0.148$) and showed non-significant relationship with spike length ($r = 0.107$) and negatively correlated with days to maturity ($r = 0.614$). Days to maturity showed negative and non-significant correlation coefficients with spike length ($r = -0.212$), number of grains spike⁻¹ ($r = -0.024$), harvest index ($r = -0.068$) and grain yield ha⁻¹ ($r = -0.054$) and it showed positive and non-significant relationship with seed index ($r = 0.008$). The spike length was positively and significantly associated with number of grains spike⁻¹ ($r = 0.811$), seed index ($r = 0.720$), harvest index ($r = 0.702$) and grain yield ($r = 0.769$). Grains spike⁻¹ exhibited positive correlation with the seed index ($r = 0.389$), harvest index ($r = 0.886$) and grain yield ($r = 0.860$). Seed index was positively and significantly correlated with harvesting index ($r = 0.946$) and grain yield ($r = 0.878$) and other plant traits. The harvest index recorded positive relationship with grain yield ($r = 0.949$) and other plant traits. An increase in

wheat crop grain yield was positively associated with plant height ($r = 0.431$), number of tillers ($r = 0.419$), spike length ($r = 0.757$), number of grains spike⁻¹ ($r = 0.860$), seed index ($r = 0.878$) and harvesting index ($r = 0.949$). Whereas, the grain yield showed non-significant and negative association with flowering days ($r = 0.146$) and maturity days ($r = -0.054$) (Table 1).

The results of the study agree with the findings of Campbell *et al.*^[8] suggested that multiple regression should be used to relate straw yield, number of tillers/plant, number of grains spike⁻¹ and seed index with grain yield. Trapeznikov *et al.*^[9] reported that with an increase of N and P fertilizer levels in case of band application increased the days for flowering. The results are further supported by Jacobsen *et al.*^[10] reported that the banded fertilizer stimulated growth early in the growing season and maturity increased with increase in N concentrations. Rusan and Pan^[11] observed the significantly greater number of tillers per plant under the N and P placement in band application. Malik and Kroll^[12] observed that spike length of wheat crop was greater under the placement of N through band application. Further, Rusn and Pan^[11] reported that spike length increased with the increased the level of N and P fertilizer and nitrogen placement method. Pramod and Rattan^[13] suggested that the application of urea alone or in various combination in case of band application or sown seed below increased the number of grains spike⁻¹. The results are further supported with the findings of Haderlein *et al.*^[14] observed that seed placed with fertilizer or N banded increased the number of grains spike⁻¹. Khan *et al.*^[15] reported that the performance of different varieties under placement of nitrogen as band application increased the 1000 grain weight. The finding of the study are further supported by EL-Badry^[16] was in the view that the application of N placement with copper fertilizer increased the 1000 grain weight and grain yield. Malhi and Nyborg^[5] observed that the method of placement have significant effect on the efficiency of nitrogen fertilizer by increasing the yield. Tila *et al.*^[7] reported that highest grain yield was recorded by combined application of

Table 1: Correlation coefficient (r) values of wheat crop parameters under different nitrogen levels and placements

	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.508	1.000							
3	0.084ns	0.015ns	1.000						
4	-0.037	0.010ns	0.614	1.000					
5	0.493	0.418	0.0107ns	-0.212	1.000				
6	0.442	0.471	0.299	-0.02ns	0.811	1.000			
7	0.287	0.356	0.316	0.008ns	0.720	0.889	1.000		
8	0.319	0.333	0.227	-0.068ns	0.702	0.885	0.946	1.000	
9	0.431	0.419	0.164ns	-0.05	0.757	0.860	0.878	0.949	1.00

1. Plant height (cm), 2. Number of productive tillers per plant, 3. Days to flowering, 4. Days to maturity, 5. Spike length (cm), 6. Number of grains per spike, 7. Seed index, 8. Harvest index, 9. Grain yield (kg ha⁻¹)

N and P with band application method. From the present study, it was concluded that determination of correlation coefficient values of plant traits help in estimating the degree of relationship, which could be used for predicting the response of yield in any crop.

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