6.	NL 1417	CIMMYT, Mexico
7.	Bhirkuti	CIMMYT, Mexico
8.	BL 4919	Nepal
9.	NL 1376	CIMMYT, Mexico
10.	NL 1179	CIMMYT, Mexico
11.	NL 1350	CIMMYT, Mexico
12.	NL 1387	CIMMYT, Mexico
13.	NL 1350	CIMMYT, Mexico
14.	NL 1420	CIMMYT, Mexico
15.	NL 1384	CIMMYT, Mexico
16.	NL 1346	CIMMYT, Mexico
17.	NL 1404	CIMMYT, Mexico
18.	NL 1413	CIMMYT, Mexico
19.	NL 1386	CIMMYT, Mexico
20.	NL 1381	CIMMYT, Mexico

3.5 Agro-metrological data:

Weather data was recorded in IAAS Paklihawa, Bhairahawa during the experimental period (26th December 2021 to 14th & 17th April 2022)

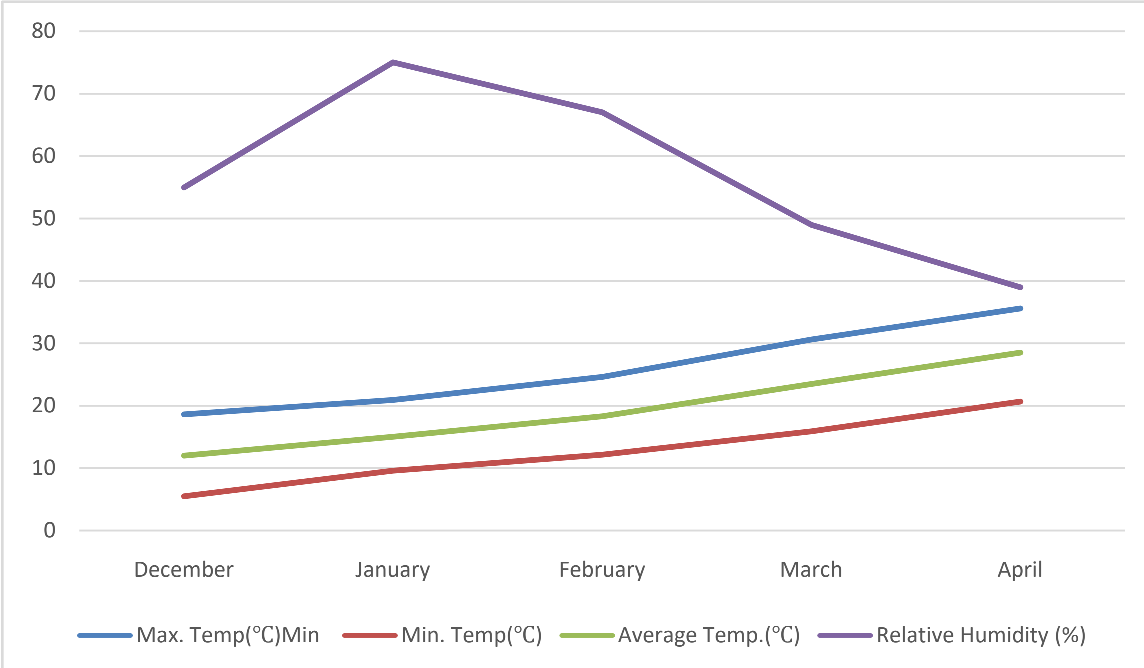

Figure 2: Weather data from the experimental site during the crop growing season.

3.6 Traits that are studied:

Ten sample plants were selected randomly from each plot to collect data. Yield (Biological and Grain) and Yield attributing traits like Plant height (PH), Spike length (SL), Spike weight (SW), Plant population per m2 area (S/m2), Number of grains per spike (NGPS), Number of spike per spikelet (NSPS), 1000 kernels weight (TKW) and Harvest Index (HI) were noted.

3.8 Statistical Analysis :

Data were entered by using Microsoft Excel Spreadsheet Software. Co-relation and path coefficient analysis was done by using SPSS and Microsoft Excel.

4. Result and discussion:

Association of characters

From table 1, it is verified that the genotypic correlation coefficients and phenotypic correlation coefficients showed equal magnitude which revealed that the presence of inherent genetic relationships among various characters is more likely dependent on the environment.

PHENOTYPIC AND GENOTYPIC CORRELATION:

Genotypic correlations among the 20 genotypes of wheat were presented in Table 1. The table showed that plant height has a positive genotypic correlation with all the studied traits except spike per meter square (-0.352). For plant height, (Upadhyay 2020) also found the same result to spike per meter square and spike length. It shows significant positive relation with spike length (0.643), spike weight (0.561), test weight (0.504), and grain yield (0.317) for genotypic levels. For plant height, (Thapa, Jaisi, and Poudel 2022) also found the same result with grain yield.

The number of grains per spike has a positive genotypic correlation except for test weight (-0.141) and spike per meter square (-0.267) with all the studied traits. It shows positive and highly significant relation with spike length (0.426) and spikes weight (0.610) for genotypic levels. It shows a positive non-significant correlation with grain yield (0.130) for genotypic levels. For NGPS, (Thapa, Jaisi, and Poudel 2022) also found the same result with test weight and plant height.

The number of spikes per meter square has a positive correlation with all the traits except spike length (-0.149) and test weight (-0.062) for both genotypic levels. It shows a positive and significant correlation with grain yield (0.318) for genotypic and phenotypic levels. For NSPS, (Thapa, Jaisi, and Poudel 2022) also found the same result with test weight.

Spike length has a positive correlation with all the studied traits except spike per meter square (-0.412) for both genotypic levels. It shows positive and highly significant relation with spike weight (0.541), test weight (0.501), NGPS (0.426), PH (0.643), and negative and highly significant with spike per meter square (-0.412) for genotypic levels. For spike length, (Upadhyay 2020) also found the same result with grain yield. For SL, (Thapa, Jaisi, and Poudel 2022) also found the same results with spike weight, grain yield, and NSPS.

Spike weight has a positive relationship with all the studied traits except spike per meter square (-0.428) for both genotypic levels but has a negative and highly significant relation with spike per meter square. It shows positive relation with grain yield (0.233). It shows positive and highly significant with plant height (0.561), NGPS (0.610), spike length (0.501), and test weight (0.403) for both genotypic levels.

Test weight has a positive correlation with all the studied traits except NGPS (-0.141), NSPS (-0.062), and spike per meter square (-0.281) for genotypic levels. It shows positive and highly significant relationship with plant height (0.504), spike length (0.501), and spike weight (0.403) for both levels. For test weight, (Upadhyay 2020) also found the same result with spike length.

Spike per meter square has a negative and significant relation with plant height (-0.352), spike length (-0.412), spike weight (-0.428), and positive relation with grain yield for genotypic and levels with studied traits. Only the NSPS (0.093) has a positive correlation for both genotypic and phenotypic levels. For spike per meter square, (Upadhyay 2020) also found the same result with plant height.

Grain yield has a positive correlation with all the studied traits. It shows significant positive relation with plant height (0.317), NSPS (0.318), and spike per meter square (0.365) for both genotypic and phenotypic levels.

Table 1. Genotypic correlation coefficient of the 8 quantitative traits of wheat genotypes at Rupandehi, Bhairahawa under drought and heat stress condition.

Correlations

	PH	NGPS	NSPS	SL	SW	Test weight	S/m2	Yield
PH	1	0.273	0.027	.643**	.561**	.504**	-.352*	.317*
NGPS	0.273	1	0.276	.426**	.610**	-0.141	-0.267	0.130
NSPS	0.027	0.276	1	-0.149	0.282	-0.062	0.093	.318*
SL	.643**	.426**	-0.149	1	.541**	.501**	-.412**	0.244
SW	.561**	.610**	0.282	.541**	1	.403**	-.428**	0.233
Test weight	.504**	-0.141	-0.062	.501**	.403**	1	-0.281	0.310
S/m2	-.352*	-0.267	0.093	-.412**	-.428**	-0.281	1	.365*
Yield	.317*	0.130	.318*	0.244	0.233	0.310	.365*	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

PH= plant height, NGPS= number of grains per spike, SL= spike length, S/m^2= spike per meter square

PATH COEFFICIENT OF DROUGHT STRESS CONDITION:

The path coefficient is a standard partial regression analysis that divides the correlation coefficient into direct and indirect effects. In this research, we studied about response variable grain yield (GY) and seven predictor variables: Plant height (PH), No. of grains per spike (NGPS), No. of spikelets per spike (NSPS), Spike length (SL), Spike weight (SW), Test weight and Spike per meter square (S/m2). (Table 2)

Direct effect:

It was observed that S/m2 has the highest positive direct effect on grain yield under the drought stress condition (0.612). It is followed by test weight (0.3228). Other traits that exert positive direct effects on Grain yield are PH (0.213), NGPS (0.136), NSPS (0.27), SL (0.187), and Test weight (0.322). This indicates that increase in any one of the above traits may directly contribute towards grain yield. Here, S/m2 has the greatest contribution to increasing grain yield. Upadhyay (2020) and (Mujahid. et al., 2004) research findings were in line with this finding. (Thakur et al., 2018) also reported that 1000 grain weight have direct effect on grain yield per plant. Spike weight exerted a negative direct effect on grain yield (-0.016).

Spike length, thousand kernel weight, number of spike per meter square (Khan and Naqvi 2012) (Mohammad et.al 2002), number of grains per spike have direct positive effect on grain yield (Upadhyay 2020) and (Singh et al. 2012). The traits that directly affect grain yield can be selected in future for better performance of plant (Nasri et al. 2014) .

Indirect effect

Plant height possessed the highest positive indirect effect on grain yield via the test weight (0.162). It is followed by the values of spike length positive indirect effect on grain yield via test weight (0.161). After that again, positive indirect effect of spike length on grain yield via plant height (0.137).

Spike weight possesses a highest negative indirect effect via S/m2 (-0.262) on grain yield. It is followed by spike length indirect negative effect on grain yield via S/m2 (-0.252). Then, plant height possesses negative indirect value via S/m2 (-0.215) on grain yield.

Table 2: Path Coefficient analysis showing direct and indirect effects of seven traits on grain yield.

	PH	NGPS	NSPS	SL	SW	Test weight	S/m2
Via PH	**0.21373**	0.058244	0.005688	0.137428	0.119903	0.10772	-0.07523
Via NGPS	0.037198	**0.1365**	0.037643	0.058149	0.083265	-0.0193	-0.03646
Via NSPS	0.007188	0.074484	**0.27009**	-0.04023	0.076237	-0.01683	0.025222
Via SL	0.120845	0.080062	-0.028	**0.18794**	0.101676	0.094158	-0.07743
Via SW	-0.00898	-0.00977	-0.00452	-0.00866	**-0.01601**	-0.00645	0.006852
ViaTest weight	0.162691	-0.04564	-0.02012	0.161723	0.130088	**0.3228**	-0.09063
Via S/m2	-0.21566	-0.16363	0.057214	-0.25242	-0.26222	-0.17202	**0.61267**
Yield	0.317011	0.130257	0.318006	0.243927	0.232936	0.310081	0.364993

0.317	PH
0.130	NGPS
0.318	NSPS
0.244	SL
0.233	SW
0.310	Test weight
0.365	S/m2

6. Conclusion

The correlation coefficient of the above-studied traits shows a positive correlation for genotypic levels with grain yield. So, from the above study, the number of spikelets per spike exerted the greatest influence directly and indirectly upon grain yield. Therefore, significant positive correlated traits having a positive direct effect on grain yields like NSPS, PH, and S/m^2 of wheat should be given much attention while selecting genotypes as these characters are helpful for indirect selection. In pathway coefficient analysis, S/m2 have strong direct positive effect on grain which was followed by test weight. For better performance, the traits that have positive direct affect on grain yield are to be selected.

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