Biological Forum – An International Journal 14(4): 101-107(2022)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Investigation of Correlation and Regression Analysis and Crop Weather Relationships in Three different varieties of Chickpea under Coastal Agro-Ecosystem of Andhra Pradesh

A. Suryakala[1], V. Radha Krishna Murthy[2] and M. Sree Rekha[3]*
[1]*M.Sc. Ag. (Agronomy), Acharya N.G. Ranga Agricultural University, Agricultural College, Bapatla (Andhra Pradesh), India.*
[2]*Professor, Department of Agronomy, Acharya N.G. Ranga Agricultural University, Agricultural College, Bapatla (Andhra Pradesh), India.*
[3]*Professor, Department of Agronomy, Acharya N.G. Ranga Agricultural University Lam, Guntur (Andhra Pradesh), India.*

(Corresponding author: A. Suryakala)*
(Received 03 August 2022, Accepted 20 September, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Understanding the relationships between chickpea (*Cicer arietinum* L.) yield, yield components and weather health indices is critical to identify the desirable varieties suitable to various climatic conditions. This research was done in order to investigate the relationships between grain yield, yield attributes and weather health indices by using correlation and regression analysis. A 5 × 3 factorial experiment in randomized complete block design (RCBD) format with three replications was conducted in the research field of the Acharya NG Ranga Agricultural University, Agricultural college, Bapatla during rabi season of 2018 to 2019. Treatments allocated were five sowing dates (2nd fortnight of October, 1st and 2nd fortnight of November, 1st fortnight of December) and three chickpea varieties (NBeG-47, NBeG-49, NBeG-119). The results revealed that grain yield and yield components of chickpea are significantly affected by both sowing date and cultivar. The correlation co-efficient analysis indicated that the seed yield of chickpea varieties was significantly influenced by the harvest index, drymatter, seed index, number of branches per plant, number of pods per plant, number of seeds per pod and days to maturity except for plant height and haulm yield. Regression equations indicated significant linear relationship for both total drymatter and seed yield of all the three varieties with climatic normals/weather health indices *viz.,* GDD, HTU, PTU, PTI, TPR, HUE, HtUE and PtUE. Statistical models for yield prediction were developed for all the three varieties of chickpea by using Step down regression analysis. Significant linear relationship was noticed for all the three varieties of chickpea and found that rainfall during reproductive stage, maximum and minimum temperature during vegetative and reproductive stage and relative humidity at evening for both reproductive and maturity stages were found to have significantly linear relationship with the yield for all the three varieties of chickpea.

Keywords: Chickpea, Correlation, Regression, Weather health indices.

INTRODUCTION

Chickpea (*Cicer arietinum* L.), is one of the widely grown *rabi* pulse crop which is consumed by majority of the world's population to a supplement protein in our diet (Xalxo *et al.*, 2021). It is a premium pulse crop grown primarily in semi-arid and warm temperate regions of the world. It is commonly referred to as Gram or Bengalgram. It is grown in more than 50 countries, with more than 90% of production coming from Asia, predominantly India. It occupies third position in the list of the food legumes which are cultivated throughout the world (FAOSTAT, 2017). In 2016, India produced 64% of the world's total chickpea. Globally, the area and production under chickpea is highest in India and productivity is highest in Israel. In India, chickpea occupied an area of 105.73 lakh hectares with a production of 111.58 lakh tonnes and productivity of 1078 kg ha^{-1} (http://www.indiastat.com, 2017-18). In A.P. it was cultivated in an area of 5.21 lakh hectares with a production of 6.76 lakh tonnes and productivity of 1062 kg ha^{-1} (http://www.indiastat.com, 2017-18).

The weather during the chickpea growing season and the overall climate have a significant impact on the growth and development of the chickpea crop. The expression of phenotypic traits was the result of interaction of genotype and the environment in chickpea (Murthy *et al.,* 2017). At different stages of the crop development, several physical and biotic factors operate simultaneously and limits the chickpea plant growth. Among the various agronomic practices, optimum planting time is the crucial non-monetary input as it has a crucial role in fully utilizing the genetic potentiality and provides the best possible growing conditions such as light, temperature, rainfall and humidity. Climate has profound influence on crop growth, phenological development, occurrence of pests and diseases and crop productivity. The plant environment such as temperature, photoperiod and sunshine hours were significantly changed with the time of planting. Deviation from the optimum planting time *i.e.,* early or delayed planting decrease yield of chickpea. Crop exposure to high temperatures and humidity due to early planting induces excessive vegetative growth, seedling mortality and poor pod set. The delayed planting leads to suppressed vegetative growth and pod bearing branches, lower biological nitrogen fixation, and may lead to forced maturity as well as increased incidence of pests and diseases. The yield potential of chickpea physiologically depends largely on cultivar selected and sowing time. The main causes of yield variability are genotypic and genotype × environment interactions. Even under good management conditions, a good variety often fails to express its potential unless it is grown under proper weather conditions. Therefore, sowing time was a very important factor for high yield. Selection of proper variety for a set of agro-climatic conditions is very important to achieve maximum yield potential because of differential growth and developmental behavior due to different genetic characters of varieties. Many improved chickpea varieties have been developed in India and Andhra Pradesh but their performance varies in a region itself. The seed yield in chickpea is based on balance or overall net effects produced by various yield contributing traits and interactions with them (Janghel *et al.,* 2020).

"Weather health" for crop production is defined as "The potential force through which weather elements perform their several and cooperative functions optimally for better crop health to produce potential yields" (Murthy, 2016). The weather health indices are Growing Degree Days, Heliothermal Units, Photothermal Units etc., and their efficiencies. The agroclimatic/weather health indices have potential for adoption and use in research on pulse based production system to relate crop growth, phenological development and yield. The concept of agroclimatic/weather health indices assumes that there is a direct linear relationship between growth of crops and air temperature (GDD), sunshine hours (HTU) and day length (PTU) and their efficiencies (Murthy, 2015). These indices provide a scientific basis for determining the effects of temperature, photoperiod etc., on phenological behaviour of the crop.

Chickpea crop is grown in 1,80,000 hectares of area in coastal areas of Andhra Pradesh and the livelihoods of more than two lakh of farmers depend on its performance. Chickpea is a fast emerging crop extensively grown in Prakasam district of Krishna Agro-climatic Zone of Andhra Pradesh in *rabi* season. The seed yield in chickpea is based on balance or overall net effects produced by various yield contributing traits and interactions with them. It is necessary to understand the traits interaction with each other as well as with environments to aid the selection of chickpea varieties suitable to particular climate (Janghe *et al*., 2020). Identifying crop varieties that are suitable for new production environments is key to increasing crop expansion, adaptation and overall productivity (Richards *et al*., 2022). Prediction models related to weather variables and crop yield is the need of the hour. So, the present investigation entitled "Investigation of correlation and regression analysis and crop weather relationships in three different varieties of chickpea under coastal agro-ecosystem of Andhra Pradesh" was conducted.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College Farm, Bapatla in clay soils during *rabi* 2018-19. The experiment was laid out in Randomized Block Design with factorial concept and replicated thrice. The treatments consisted of three varieties of chickpea *viz.,* NBeG-47, NBeG-49 and NBeG-119 as first factor and five sowing dates *viz.,* 2^{nd} fortnight of October, 1^{st} fortnight of November, 2^{nd} fortnight of November, 1^{st} fortnight of December and 2^{nd} fortnight of December as second factor. Each variety was sown with a spacing of 30cm × 10cm. Fertilizers were applied @ 20:40:20 kg of N: P_2O_5: K_2O along with 3.0 tons of farm yard manure (FYM) per ha. Other cultural operations or practices were done as per normal package of practices followed in the crop. A sample size of five random plants of each variety from each replication were used for the collection of data on quantitative traits. Correlation and regression are carried out to establish inter-relationship among agronomic traits including seed yield (Sasmita *et al*., 2021). Correlation and regression analysis were performed by using IBM SPSS statistics software. Step-down regression analysis was used to derive a relation between yield and weather parameters which was used to predict the yields of chickpea varieties with changing environmental conditions.

RESULTS AND DISCUSSION

Interrelation of growth parameters and yield components with yield. The correlation is one of the most common and most useful statistics. A correlation is a single number that describes the degree of relationship between two variables. It is a statistical technique that can show whether and how strongly pairs of variables are related (Biabani *et al*., 2021). The relationship between morphophysiological parameters and seed yield of chickpea varieties was assessed by working out the correlation coefficients. The correlation coefficient analysis indicated that the grain yield of chickpea varieties was significantly influenced by the harvest index, drymatter, seed index, number of branches per plant, number of pods per plant, number of seeds per pod and days to maturity (Table 1). The seed yield was significantly influenced by all the parameters except for haulm yield and plant height. But all the morpho-physiological parameters were strongly associated with significant correlation coefficients. These results corroborates with the findings of Kobraee *et al.,* (2010); Ali *et al.* (2011); Dawane *et al*. (2020); Raju and Lal (2021); Sasmita *et al*. (2021). Ozdemir and Karadavut (2003) reported that the longer growing period of autumn sowing chickpeas affected yield attributes such as branches per plant, number of pods per plant, number of seeds per pod and seed index, which in turn contributed to increased seed yield.

Table 1: Correlation of seed yield with growth parameters, yield attributes and yield.

Attributes	Grain yield	Haulm yield	Harvest index	Drymatter	Seed index	No. of branches per plant	No. of pods per plant	No. of seeds per pod	Plant height	Days to maturity
Grain yield	1	0.369	0.969**	0.994**	0.617*	0.819**	0.799*	0.683**	0.426	0.795**
Haulm yield		1.00	0.145	0.321	0.267	0.262	0.43	0.132	0.26	0.404
Harvest index			1.00	0.997*	0.718**	0.799**	0.846**	0.742**	0.460	0.748**
Drymatter				1.00	0.665**	0.810*	0.813**	0.702**	0.421	0.766**
Seed index					1.00	0.260**	0.409	0.440	0.070	0.112
No. of branches per plant						1.00	0.925**	0.802**	0.789**	0.956**
No. of pods per plant							1.00	0.804**	0.823**	0.865*
No. of seeds per pod								1.00	0.701**	0.723**
Plant height									1.00	0.797**
Days to maturity										1.00

*and** indicates significance at 5% and 1% level, respectively.

Step down regression analysis for three chickpea varieties

Table 2: The statistical models developed for yield prediction through step down regression are as follows.

Variety	Equation	Coefficient of determination (R^2)
NBeG-47	$Y = -17968.54 + 434.48\,(MAT_1) - 147.49\,(MIT_2) + 67.85\,(RH_{22}) + 61.23\,(RH_{23})$	0.99*
NBeG-49	$Y = 15.12 - 95.65\,(RF_3) + 143.74\,(MAT_1) - 14.09\,(RH_{22}) - 23.13\,(RH_{23})$	0.98*
NBeG-119	$Y = 5590.49 + 7.59\,(RF_2) - 113.78\,(RF_3) - 180.7\,(MAT_2) + 20.8\,(RH_{23})$	0.98*

* Significant
Y = Grain Yield
MAT_1 = Maximum Temperature at vegetative phase.
MAT_2 = Maximum Temperature at reproductive phase.
MIT_2 = Minimum Temperature at reproductive phase.
RH_{22} = Relative Humidity in the evening at reproductive phase.
RH_{23} = Relative Humidity in the evening at maturity phase.
RF_2 = Rainfall at reproductive phase.
RF_3 = Rainfall at maturity phase.

Chickpea is a C_3, long day plant. It is rainfall sensitive during vegetative stage, requires low temperature during reproductive stage and relatively high temperature during maturity. In order to develop a relationship between the yield as a dependent variable (Y) and weather elements like rainfall (RF), minimum temperature (MIT), maximum temperature (MAT) and relative humidity (RH) as independent variables, the step wise regression analysis was done for three varieties of chickpea *viz.,* NBeG-47(V_1), NBeG-49 (V_2) and NBeG-119(V_3) (Gupta *et al*., 2013).

The grain yield of chickpea varieties can be predicted with high degree of captured variances ranging from 98 to 99. The grain yield of NBeG-47 (V_1) variety depended on maximum temperature at vegetative phase (MAT_1), minimum temperature at reproductive phase (MIT_2), relative humidity during evening in the reproductive phase (RH_{22}) and relative humidity during evening in the maturity phase. The grain yield of NBeG-49 (V_2) variety depended on rainfall during maturity phase (RF_3), maximum temperature at phase, relative humidity during evening in the reproductive phase (RH_{22}) and relative humidity during evening in the maturity phase (RH_{23}). The grain yield of NBeG-119 (V_3) variety depended on rainfall during vegetative phase (RF_2), rainfall during maturity phase (RF_3) maximum temperature at vegetative phase, and relative humidity during evening in the maturity phase (RH_{23}). These results clearly indicate that maximum temperature, minimum temperature, relative humidity and rainfall determined the chickpea grain yield when implied together (R^2 = 0.98) in coastal agro-ecosystem of Andhra Pradesh (Table 2). These findings agree with those reported by Ozdemir and Karadavut (2003); Ilkaee *et al.* (2014).

This indicates that by using daily recorded data of temperature, relative humidity, photoperiod, day length and sunshine hours during the crop season, these regression equations can be applied to predict chickpea growth and yield. The grain yield of chickpea varieties can be predicted with the help of weather parameters with high degree of captured variances of 98% accuracy. The yield of NBeG-47 (V_1) depends upon maximum temperature at vegetative stage (MAT_1), minimum temperature at reproductive stage (MIT_2) and relative humidity during evening in the reproductive phase (RH_{22}) and maturity phase (RH_{23}). The grain yield of NBeG-49 (V_2) variety depended on maximum temperature at vegetative stage (MAT_1), relative humidity during evening in the reproductive phase (RH_{22}) and maturity phase (RH_{23}) and rainfall during maturity phase (RF_3). For NBeG-119 (V_3) grain yield was depended on maximum temperature at reproductive phase (MAT_2), relative humidity during evening in the maturity phase (RH_{23}), rainfall during reproductive (RF_2) and maturity phase (RF_3). These results clearly indicate that minimum and maximum temperature, relative humidity and rainfall determined the grain yield of chickpea in coastal agro-ecosystem of Andhra Pradesh.

Temperature Disparity (TD). The data on total temperature disparity (TD) prevailed at different growth phases of chickpea crop sown on different sowing dates are presented in Table 3. The data on total TD recorded for the entire crop duration was ranged between 465 to 1757. Relatively higher TD values were observed with NBeG-119 (V_3) and the lower TD values were observed with NBeG-47 (V_1) followed by NBeG-49 (V_2) variety sown on 2nd fortnight of October. The results corroborate with the findings of Kumar (2018). This might be due to longer duration of crop and the highest variation between maximum and minimum temperatures. Among the dates of sowing, 2nd fortnight of October (D_1) recorded the highest TD values and the lowest TD values were recorded with the 2nd fortnight of December (D_5).

Humidity Disparity (HD). The data on total humidity disparity (HD) prevailed at different growth phases growth of chickpea crop are presented in Table 4. The HD values observed in the investigation ranged between 216 to 1009 for different phenophases. Among the dates of sowing 2nd fortnight of October (D_1) recorded higher total HD irrespective of all the varieties and the lower HD was with 2nd fortnight of December (D_5). Among the varieties, NBeG-119 (V_3) recorded the higher HD values compared to remaining varieties under study. These results are in accordance with the findings of Manikanta (2017).

Table 3: Total temperature disparity (TD) prevailed at different phenophases of chickpea varieties at different dates of sowing (data statistically not analyzed).

Total temperature disparity						
Growth stages	Dates of sowing (D)					Mean
	(D_1) 2nd FN of October	(D_2) 1st FN of November	(D_3) 2nd FN of November	(D_4) 1st FN of December	(D_5) 2nd FN of December	
(V_1) NBeG-47						
GS 1	1424	1436	1556	1601	1639	1625
GS 2	831	897	808	672	565	770
GS 3	1575	1043	867	841	465	975
Total	3830	3376	3231	3114	2668	
(V_2) NBeG-49						
GS 1	1498	1471	1605	1674	1679	1679
GS 2	898	991	819	717	525	805
GS 3	1469	1191	1059	845	579	1045
Total	3865	3652	3483	3236	2715	
(V_3) NBeG-119						
GS 1	1574	1544	1707	1715	1757	1754
GS 2	868	961	807	716	535	799
GS 3	1524	1302	944	774	523	1023
Total	3965	3807	3458	3205	2815	

Table 4: Total humidity disparity (HD) prevailed at different phenophases of chickpea varieties at different dates of sowing (data statistically not analyzed).

Total humidity disparity						
Growth stages	Dates of sowing (D)					Mean
	(D_1) 2nd FN of October	(D_2) 1st FN of November	(D_3) 2nd FN of November	(D_4) 1st FN of December	(D_5) 2nd FN of December	
(V_1) NBeG-47						
GS 1	594	592	760	796	913	973
GS 2	383	540	371	328	264	396
GS 3	862	546	449	468	278	522
Total	1839	1678	1580	1591	1455	
(V_2) NBeG-49						
GS 1	636	600	796	822	941	1000
GS 2	421	589	347	397	236	418
GS 3	780	587	630	423	306	547
Total	1836	1776	1773	1642	1461	
(V_3) NBeG-119						
GS 1	666	626	868	837	1009	1038
GS 2	423	582	356	413	216	427
GS 3	786	618	559	369	266	517
Total	1875	1825	1783	1619	1492	

Relationship between Total Drymatter/Seed Yield and Weather Health Indices for different Chickpea Varieties. An attempt was made to establish the relationship between TDM/SY and weather health indices by using linear regression equations which were obtained between total drymatter (TDM)/seed yield (SY) of chickpea as dependent variable and weather health indices / climatic normal *viz.,* GDD, HTU, PTU, PTI, HUE, TPR, HtUE and PtUE as independent variables for three varieties of chickpea. Fig. 1, 2 represents the relationship of TDM/SY with GDD for three varieties of chickpea. Same trend was observed with remaining weather health indices *viz*., HTU, PTU, PTI, HUE, TPR, HtUE and PtUE. Significant linear relationship was observed for drymatter and grain yield for all the three varieties of chickpea with weather health indices with R^2 values ranged between 0.74 to 0.98. The highest values of coefficient of determination (R^2) for all three varieties indicated that the production of drymatter and grain yield depended on all these weather health indices.

Relationship between Total Drymatter/ Seed Yield of Chickpea Varieties and Weather Health Indices under different sowing dates. Linear regression equations were obtained between agro-climatic indices/weather health indices *viz.,* GDD, HTU, PTU, TPR, HUE, HtUE, PtUE, and PTI as independent variables and total drymatter TDM/SY as dependent variables for three chickpea varieties at five different dates of sowing. Fig. 3 to Fig. 4 represents the relation between TDM/SY and GDD for five sowing dates. Same trend was observed with remaining weather health indices. Significant linear relationship was observed for drymatter and grain yield for all five different dates of sowing with weather health indices with R^2 values ranged between 0.71 to 0.99. The highest values of coefficient of determination (R^2) for all three chickpea varieties at five different dates of sowing indicated that the production of drymatter and grain yield depended on all these weather health indices.

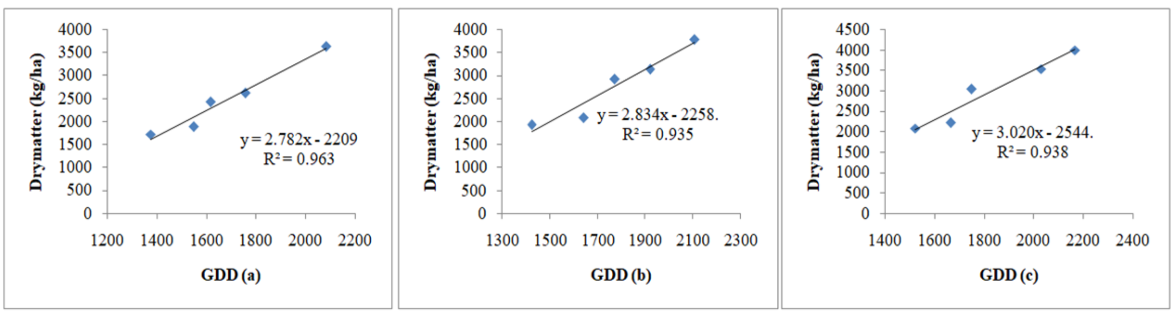

Fig. 1. Relationship between total drymatter (kg ha^{-1}) and growing degree days (a) NBeG-47 (b) NBeG-49 (c) NBeG-119.

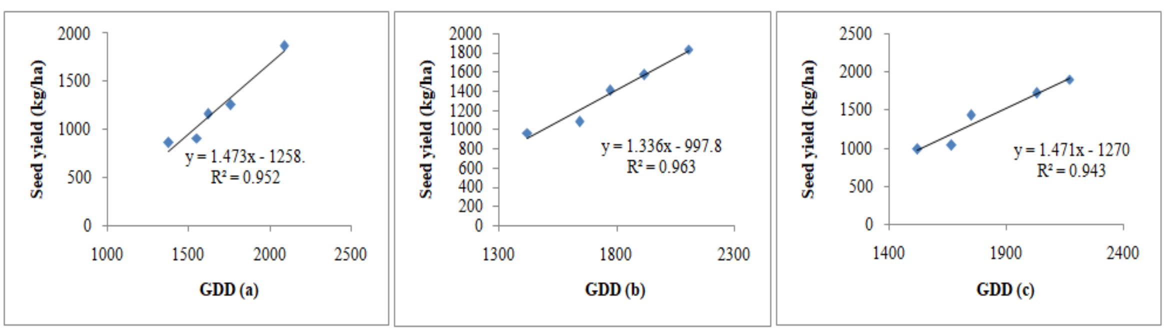

Fig. 2. Relationship between Seed yield (kg ha^{-1}) and growing degree days (a) NBeG-47 (b) NBeG-49 (c) NBeG-119.

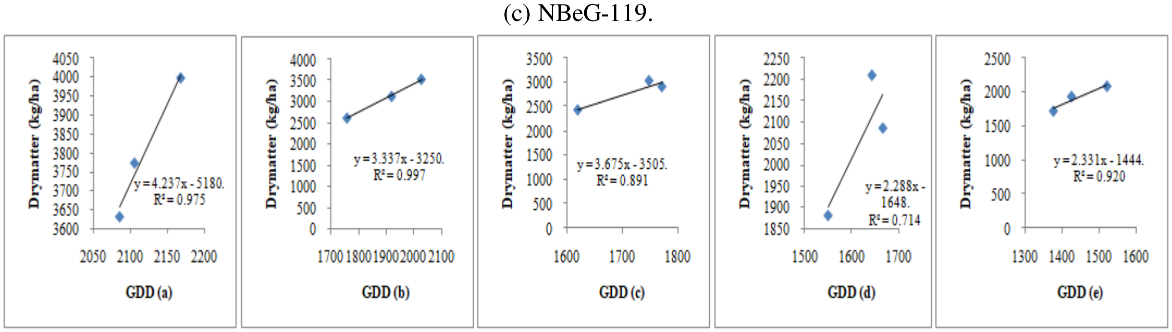

Fig. 3. Relationship between Total Dry matter(kg ha^{-1}) and Growing degree days for five dates of sowing (a) D_1, (b) D_2, (c) D_3, (d) D_4, (e) D_5.

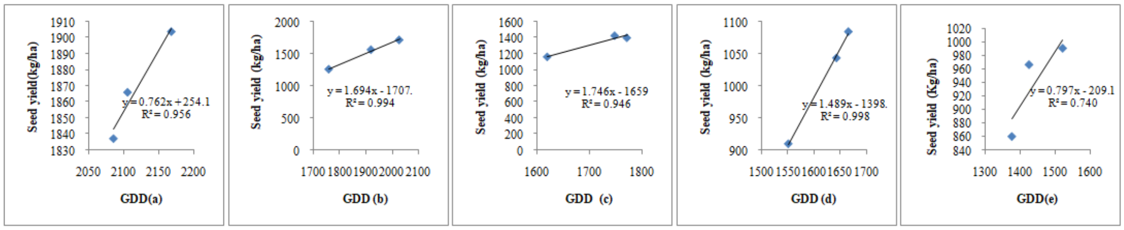

Fig. 4. Relationship between seed yield (kg ha^{-1}) and Growing degree days for five dates of sowing (a) D_1, (b) D_2, (c) D_3, (d) D_4, (e) D_5.

CONCLUSION

The statistical models for weather resilient yield prediction of the chickpea varieties tested through regression equations were found to have significant linear relation with yield. Linear regression equations were developed between total drymatter and seed yield as dependent variables and weather health indices *viz.,* GDD, PTU, PTI, HTU, HUE, HtUE, PtUE and TPR as independent variables, for all five different dates of sowing and three varieties. Significant linear relationship was observed for both total drymatter and seed yield for all the three varieties of chickpea with weather health indices. The highest values of co-efficient of determination (R^2) for all the three varieties indicated that the production of drymatter and seed yield depended heavily on all these weather health indices. This indicates that these regression equations can be applied to predict chickpea growth and yield by using daily recorded data of temperature, relative humidity, photoperiod, day length and sunshine hours during the crop season.

The seed yield of chickpea varieties can be predicted with weather parameters with high degree of captured variances. In this study, the seed yield of NBeG-47 (V_1) depended on maximum temperature at vegetative stage (MAT_1), minimum temperature at reproductive stage (MIT_2) and relative humidity during evening in the reproductive phase (RH_{22}) and maturity phase (RH_{23}). The seed yield of NBeG-49 (V_2) variety depended on maximum temperature at vegetative stage (MAT_1), relative humidity during evening in the reproductive phase (RH_{22}) and maturity phase (RH_{23}) and rainfall during maturity phase (RF_3). For NBeG-119 (V_3), seed yield was depended on maximum temperature at reproductive phase (MAT_2), relative humidity during evening in the maturity phase (RH_{23}), rainfall during reproductive (RF_2) and maturity phase (RF_3). The results clearly indicated that minimum temperature, maximum temperature, relative humidity and rainfall determined the seed yield of chickpea in coastal agro-ecosystem of Andhra Pradesh.

FUTURE SCOPE

This type of research work has to be done in multilocations for newly released varieties of different crops, so that one can identify the potential variety for a particular location. It can also be used to study the impact of dates of sowing and varieties of chickpea on yield attributes and yield. One can predict the yield potential of a crop's cultivar in changing climatic conditions, by deriving yield prediction model with the help of data collected on various weather parameters.

REFERENCES

Ali, Q., Tahir, M. H. N., Sadaqat, H. A., Arshad, S., Farooq, J., Ahsan, M., Waseem, M. and Iqba, A. (2011). Genetic variability and correlation analysis for quantitative traits in chickpea genotypes (*Cicer arietinum* L.). *Journal of Bacteriology Research*, *3*(1): 6-9.

Biabani, A., Katozi, M., Mollashahi, M., Bahlake, A. G. and Khani, A. G. (2021). Correlation and relationships between seed yield and other characteristics in chickpea (*Cicer arietinum* L.) cultivars under deterioration. *International Journal of Agricultural Sciences*, *11*(8): 1-4.

Dawane, J. K., Jahagirdar, J. E. and Shedge, P. J. (2020). Correlation Studies and Path Coefficient Analysis in Chickpea (*Cicer arietinum* L.). *International Journal of Current Microbiology and Applied Sciences*, *9*(10): 1266-1272.

Gupta, V., Kumar, J., Singh, M., Singh, B.N., Kumar, A. and Singh, B. (2013). Agrometerological indices for predicting growth and yield of chickpea for use in agromet advisory services. *Journal of Agrometeorology*, *15*: 174-177.

http://www.indiastat.com, (2017-18).

https://www.fao.org/faostat. (2017).

Ilkaee, M.N., Paknejad, F., Golzardi, F., Tookalloo, M. R., Habibi, D., Tohidloo, G., Pazoki, A., Agayari, F., Rezaee, M. and Rika, Z. F. (2014). *International Journal of bioscience, 4*(12): 84-92.

Janghel, D.K., Kumar, K., Verma, S. S. and Chhabra, A. K. (2020). Genetic relationships and principal component analysis in elite chickpea (*Cicer arietinum L.*) genotypes for seed yield and its component traits. *Legume Research- An International Journal*, 43(6): 770-775.

Kobraee, S., Shamsi, K., Rasekhi, B. and Kobraee, S. (2010). Investigation of correlation analysis and relationships between grain yield and other quantitative traits in chickpea (*Cicer arietinum* L.). *African Journal of Biotechnology*, *9*: 2342-2348.

Kumar, M. S. (2018). Effect of different dates of sowing and irrigation on growth and yield of chickpea cultivars and evaluation of CROPGRO chickpea model. *Msc. (Ag) Thesis*. Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh.

Manikanta, D. (2017). Climate resilient weather health indices for growth and yield of rice (*Oryza sativa.* L.). *M.Sc. (Ag.) thesis*. Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh.

Murthy, V. R. K. (2015). Climate change-weather health indices as tools and services in Agriculture. *Andhra Agricultural Journal, 62*(4): 737-745.

Murthy, V. R. K. (2016). *Principles and Practices of Agricultural Disaster Management*, B.S.Publishers, Hyderabad. Pp: 111-127.

Murthy, V. R. K., Sree Rekha, M. and Vijaya Lakshmi, B. (2017). Climate change –Jowar yield prediction model for Bapatla coastal agro-ecosystem. *The Andhra Agricultural Journal, 64*(2): 317-318.

Ozdemir, S. and Karadavut, U. (2003). Comparison of the performance of autumn and spring sowing of chickpeas in temperate region. *Turkish Journal of Agriculture, 27*(1): 345-352.

Raju, A. C. and Lal, G. M. (2021). Correlation and path coefficient analysis for quantitative traits in chickpea (*Cicer arietinum* L.). *International Journal of Botany and Research*, *11*(2): 15–22.

Richards, M. F., Maphosa, L. and Preston, A. L. (2022). Impact of Sowing Time on Chickpea (*Cicer arietinum* L.) Biomass Accumulation and Yield. *Agronomy*, *12*, 160.

Sasmita, D., Devraj, L., Swapan, K. T. and Manasi, D. (2021). Association and path analysis of morpho-agronomic traits in mungbean germplasm under cold stress. *Biological Forum – An International Journal, 13*(3): 245-248.

Xalxo, B., Lal, G. M., Debnath, S. and Tripathi, A. M. (2021). Determination of genetic association of yield and quality traits in *Cicer arietinum* L. (chickpea). *Journal of Experimental Agriculture International*, *43*(5): 75-83.

How to cite this article: A. Suryakala, V. Radha Krishna Murthy and M. Sree Rekha (2022). Investigation of Correlation and Regression Analysis and Crop Weather Relationships in Three different varieties of Chickpea under Coastal Agro-Ecosystem of Andhra Pradesh. *Biological Forum – An International Journal*, *14*(4): 101-107.