Statistical Analysis of Turmeric Crop in Telangana State

Md. Atheeq Sultan Ghori, Research Scholar, Research and Development Centre, Bharathiar University, Coimbatore.

Dr.M. Balakrishnan, Principal Scientist, National Academy of Agricultural Research Management (NAARM), ICAR, Rajendra Nagar, Hyderabad.

Abstract--- Harvest yield determining plays a critical position in cultivating arranging and control, home dinners supply, universal dinners trade, condition supportability. For instance, India has the Second greatest people in the worldwide however with confined agrarian land so precise yield estimating grants the specialists offer adequate nourishment convey to the individuals. There are numerous components that have a power any harvest yield, for instance zone, water system productivity, precipitation adaptations and Annual and Seasonal Average temperature, Average Humidity, soil top notch (N, P, K) values lastly clutter frequencies. This Effort has been made for making sense of realities in yield estimation to set up mappings among yield and some of the essential components. This watch practices inside the utilization of chronicled records of Turmeric and related manor territory, precipitation, and temperature in Telangana distric, India, indentifying actualities which help can deliver a radical level of outstanding guaging of wheat yield.

Keywords--- Crop Yield Forecasting, Estimation, Statistical Modeling, Turmeric.

I.   Introduction

Guaging of harvest yields [1] is an impressive wander extraordinarily for India. Agribusiness is one of the critical business divisions in India and the u . S .'s financial framework is exceptionally reliant on it for provincial supportability. Farming contributes around 34% inside the total national output (GDP) and offers businesses to around 36% of families in money related yr 2016 [2]. No top notch adaptation which has ordinary legitimacy exists these days. The Food and Agriculture Organization (FAO) of the United Nations (FAO) has expected that "in spite of the fact that the expansion of dinners requests are anticipated to steady to 1.2% a year over the length 2015 to 2030, by methods for 2030, an additional billion bunches of grains will regardless be wished each yr" [3]. The expanding dinners needs must be coordinated with the guide of a comparing development of suppers convey. An uneven supply– call for connection can cause tight sustenance markets and rising dinners costs. To dispatch the weight in nourishment supply, expanded abuse of arable land, edit efficiency development and increments in trimming profundity are habitually contracted [4]. Efficiency blast is the most basic issue of horticultural supply increments. Harvest yield determining plays out a urgent position in cultivating arranging and administration, home suppers convey, overall nourishment exchange, surroundings maintainability [5]. For example, India has the Second biggest populace in the worldwide however with restricted rural land so precise harvest determining encourages the administration sufficiently offer dinners supply to the general population. However there are numerous components that can influence trim yields adversely. Yearly product yields are firmly controlled by means of remarkable crossovers and particular creating circumstances, comprehensive of climate and supplement accessibility. Further, at phenomenal blast arranges, the criticalness of affect might be unmistakable for everything. Among every one of the components, soil dampness ought to have the most complex pursuing with edit advancement. We can subcategorize the effect of this issue into two components. One is water inadequacy, and the other is additional water pressure. Them two will contrarily affect plant increment and undermine trim yields. Constrained soil dampness impacts in a decline of plant water take-up. Dry spell will even intention plant tissue lack of hydration and in flip reduce shoot and root development, film uprightness and decline edit fabricating.

II.   About Turmeric

Turmeric (Curcuma Longa L.) the verifiable and hallowed zest of India alluded to as 'Indian Saffron' is a urgent modern zest edit developed in India [6]. It is likewise alluded to as the 'Brilliant Spice of ways of life" and is one of the greatest indispensable flavors utilized as a fundamental part in culinary wherever on the planet. Turmeric is a tropical lasting plant, neighborhood to India and Indonesia and is developed over the span of the tropics round the area. It is an imperative business flavor developed in India. It is a piece of Indian way of life. Indian Turmeric is contemplated best in the global. Developing to a tallness of around three ft, it bears sets of spear molded leaves of progress features of the stem. At the base of the stem there might be a bumpy rhizome somewhat similar to ginger. It

has a place with the hover of relatives Zingiberaceae [7]. Business component is rhizome or underground stem. Indian vernacular names are pasupu, haldi, manjal and kunyit in some Asian nations.Turmeric is become best in 6% of the whole territory underneath flavors and fixings in India and India is the most essential maker and exporter of turmeric inside the worldwide and bills for 78% of world's aggregate generation. Further, Turmeric is second greatest remote trade worker among Indian flavors. India expends almost eighty% of turmeric [8].

III.   Related Works

Liu B, Liu L [9] Crop yield recreations are fabulously related to conceptive stage period reenactments, which are regularly disappeared with warmness weight. In this look at, we assessed 4 broadly utilized temperature response activities of wheat phenology (Bilinear, Sin, Beta, and Trapezoidal schedules) to recreate warm pressure impacts on distribute heading interims with datasets from 4 years of condition controlled phytotron tests and multi-year subject trials over the rule wheat creation district in China. Critical rebates in post-heading length were situated with expanding warmness weight in phytotron tests. A correlation of those temperature practices imbedded in the WheatGrow display affirmed that three of the activities couldn't are expecting post-heading periods underneath warmness strain, while the Trapezoidal constant tended to overestimate extreme temperature impacts.

Mathieu, J., Aires, [10] Statistical meteorological impact designs should speak to the impact of climate on financial games, the utilization of a measurable approach. The adjustment of such forms is extreme because of the reality connections are entangled and memorable insights are restricted. Regularly, such models prevail with regards to recreating past insights however complete ineffectively on concealed new measurements (an inconvenience called overfitting). This inconvenience stresses the requirement for regularization methodologies and trustworthy appraisal of the model extraordinary. This examination represents, preferredly, how to remove relevant data from climate actualities and endeavor it in affect models which are intended to help choice making.

Moreto, V., Souza, R [11] Forecast is the demonstration of assessing a future occasion basically in light of present day data. Ten-day span (TDP) meteorological records had been utilized for displaying: recommend air temperature, precipitation and water adjust parts (water shortfall (DEF) and excess (EXC) and soil water stockpiling (SWS)). Meteorological and yield realities from 1990-2004 had been utilized for adjustment, and 2005-2010 have been utilized for experimenting with. Initial step turned into the choice of factors by means of connection examination to figure out which TDP and climatic factors have more noteworthy affect at the harvest yield. The settled on factors had been utilized to build models by method for a few direct relapse, the utilization of a stepwise in reverse technique.

N.Gandhi and L.Armstrong [12] The present research spends significant time in use of data mining procedures to remove understanding from the memorable rural dataset to expect rice trim yield for Kharif period of Humid Subtropical climatic division of India. The execution appraisal of various class techniques has been accomplished in free and open source realities mining programming WEKA (Waikato Environment for Knowledge Analysis) as a piece of this investigations on the farming dataset. The trial result gave incorporate affectability, specificity, precision, propose total bungles (MAE), root recommend squared mistake (RMSE), relative outright goofs (RAE) and root relative squared blunders (RRSE). The outcome on the current dataset shows that J48 and LADTree (Logical Analysis of Data Tree) classifiers give the remarkable general execution of the classifiers utilized as a part of this investigations.

Sandeep, I. S., Kuanar [13] Curcuma longa L. Having a place with the family Zingiberaceae is a basic zest and restorative plant. In spite of a regularly creating leisure activity and mechanical significance of curcumin and Curcuma vital oil, it's far still never again perfect with regards to the nature and method of affect the unmistakable soil and ecological components have on the generation and top notch of curcumin, leaf and rhizome essential oil of this species. The blessing record offers with 'Surama', an intemperate yielding turmeric cultivar that was developed at nine agroclimatic zones with an objective to look at the results the diverse soil and ecological parameters have on item enhancement as legitimately the high caliber of curcumin and key oil substance. In evaluation, the temperature and phosphorous substance were watched crucial for leaf fundamental oil even as, nitrogen, phosphorous and potassium substance were the key quantitative and subjective determinants for rhizome basic oil. This observe offers basic trial data that would discover powerful use in yield advancement and overseeing differing natural parameters of this vital species for intemperate and acceptable yield of curcumin, rhizome and leaf basic oil.

Chitra, R., et al. [14] The field tests have been completed for 2 seasons throughout late spring of 2004-05 and 2005-06 at Regional Agricultural Research Station Bijapur (Karnataka), on medium profound dark soil to watch the effect of planning of trickle water system on the blast, yield and water utilize proficiency of onion (cv. Telagi

Red).The test covered three interim (maintreatments) and 3 levels of irrigation(sub medicines) with surge water system as oversee. Neog, Atrayee, et [15] in an information pushed show, purchaser connects frequently with the actualities and permits to unravel specifically unstructured issues. Now, enters Machine Learning. In this works of art we endeavored to locate another method to diminish the information trademark to reduce the preparing power wished. We have endeavored at foreseeing the country yields of rice producing in a zone by means of forcing a pixel check number based absolutely compose machine considering rendition.

Through this variant, we endeavored to expect the surmised edit yield basically in view of NDVI esteems investigated for a particular season and locale. Shekhar, Himanshu [16] Potato (Solanum tuberosum L.) is lord of the vegetable plants. It is a critical harvest and can supplement the nourishment wishes of the u . S . A . Widespreadly on the grounds that it delivers more dry-tally number, adjusted protein and additional calories from unit locale of land and time than various primary nourishment crops.

To save the potato creation in beneficial route, estimation of potato yield is imperative as far as climate parameters. The investigate wind up done construct absolutely with respect to optional records. The consistently trim yield records of potato changed into collected from District Statistical Office, Dharwad. Optional realities at the atmosphere parameters have been gathered from Main Agricultural Research Station (MARS), UAS, Dharwad. The factual apparatus particularly relationship examination, relapse assessment and exceptional non direct designs had been utilized.

For evaluating kharif potato yield least temperature and least relative moistness have been watched significantly adding to the yield. Mathieu, Jordane [17] Weather majorly affects agribusiness. Factual models were utilized to gauge or conjecture trim yield from atmosphere data. In this paper, an in vogue factual structure is propelled with the goal that you can rank and evaluate the measurements content material of climate insights. The approach is tried over the USA, for corn yield.

The climate affectability of different corn generation territories is first examined. In excess of fifty agro-climatic files have been as looked at. The investigate shows that fluctuation in yield is considerably more prone to be a result of atmosphere inconstancy in medium and incidental creation areas.

IV.   Statistical Modeling

Harvest styles characterized by methods for scientific definition are utilized to mimic product blast elements comprising of direct relapse, two or three straight relapse and Non straight relapse designs. One compelling approach to perceive and investigate information is through the utilization of records representation and measurable Analysis procedures.

Collection of Data Set

In this work, we utilize the Turmeric trim inside the area of Telangana, India. The turmeric is a rain sustained harvest and sown before rainstorm season,. Despite the fact that numerous elements affect the yield of Turmeric, we remember least complex the physical elements (climatic conditions) in light of a smooth accessibility of the records. As the climatic circumstance necessities for any harvest are elite all through the presence cycle of the product, we keep in mind ecological elements of consistently as Individual issue in our observe.

In on along these lines there are 24 factors for 3 months as in Telangana Turmeric is sown inside the long stretch of Feb and gathered on the stop of the period of April.

The 24 components are regular month-to-month precipitation, greatest temperature in a month, least temperature in a month, normal month to month dampness, mean ocean organize strain, recommend wind speed (km/h), most managed speed (km/h) and wide assortment of days of rain occurred in the 9 months of yield presence cycle. These components are appeared in Table 1.

Table 1: Factors Affecting the Turmeric Production

Feb rainfall	March rainfall	April rainfall
Feb maximum temperature	March maximum temperature	April maximum temperature
Feb minimum temperature	March minimum temperature	April minimum temperature
Feb humidity	March humidity	April humidity
Feb mean sea level pressure	March mean sea level pressure	April mean sea level pressure
Feb mean wind speed	March mean wind speed	April mean wind speed
Feb maximum sustained speed	March maximum sustained speed	April maximum sustained speed

The relevant facts are obtained from unique resources. The crop manufacturing associated facts are accrued from the Ministry of Agriculture, Government of Telangana and other on-line assets of Government of Telangana. The meteorological facts are accrued from the authentic internet site of the Indian Meteorological Department and different on line assets.

Format of the information available for the crop is shown in Table 2 and format for the historical facts of physical elements of the crop lifecycle is shown. It is as follows. The rain is common monthly rainfall, max is maximum temperature in the month, min is minimum temperature in a month, hum is average monthly humidity in percent, slp is suggest sea level pressure in hPa, ws is mean wind velocity in km/h, maxws is most sustained wind velocity in km/h and days is quantity of days of rain passed off in the month.

Table 2: Sample Data of the Yield Since 2000 to 2016 of Turmeric in Telangana

Year	Production in tones	Area in Hectare	Yield in Kg/Ha
2000	92	188	436
2001	135	278	464
..	..	..	..
2012	65	331	614
2013	96	348	539
2014	118	338	666
2015	87	219	604

SPSS is an extensively utilized program for measurable assessment in social innovation. It is additionally used by commercial center specialists, wellbeing analysts, study organizations, experts, training scientists, promoting associations, records diggers, and others.

The exceptional SPSS direct has been depicted as one among "human science's most persuasive books" for enabling standard analysts to do their own one of a kind factual assessment. Notwithstanding factual assessment, data control (case determination, document reshaping, creating inferred records) and certainties documentation (a metadata word reference changed into spared inside the datafile) are elements of the base programming.

Analysis of Data Using SPSS

Engaging actualities are brief enlightening coefficients that abridge a given informational collection, which might be either a delineation of the entire people or an example of it. Elucidating records are separated into measures of imperative propensity and measures of fluctuation, or spread.

Measures of basic inclination incorporate the infer, middle and mode, in the meantime as measures of inconstancy comprise of a similar old deviation or change, the base and greatest factors, and the kurtosis and skewness.

Table 3: Descriptive Statistics (Mean, Median, Mode and Std Deviation) of Annual Average Rainfall, Precipitation, Humidity and Temperature

Statistics		Annual Rainfall	Average Precipitation	Average Humidity	Average Temperature
N	Valid	50	50	50	50
	Missing	0	0	0	0
Mean		3020.058	48.46	52.216	28.068
Median		3021.05	48.5	52.2	28.05
Mode		2594.00[a]	47.9	51.9	27.6
Std. Deviation		158.9309	0.9071	0.3266	0.9321

Table 4: Descriptive Statistics (Mean, Median, Mode and Std Deviation) of N, P, K, Area and Yield

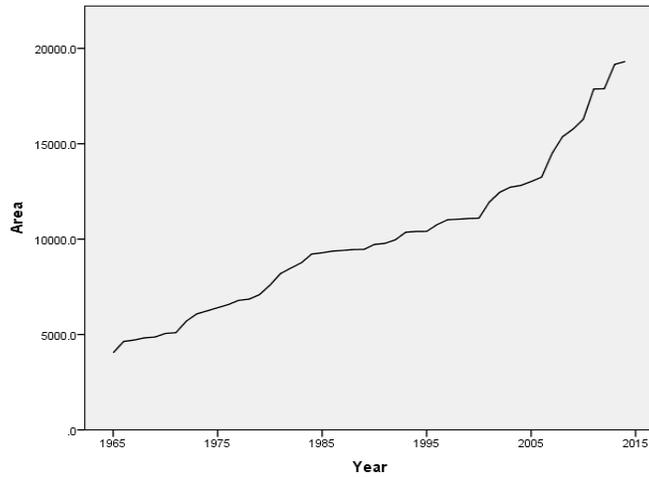| Statistics		N	P	K	Area	Yield
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Mean		109.694	33.346	31.508	10043.67	62112.02
Median		109.1	33.35	31.35	9592.4	52582.5
Mode		90.40[a]	31.00[a]	25.8	4045.0[a]	84386.6
Std. Deviation		12.39457	3.63639	4.15274	3983.195	33494.79

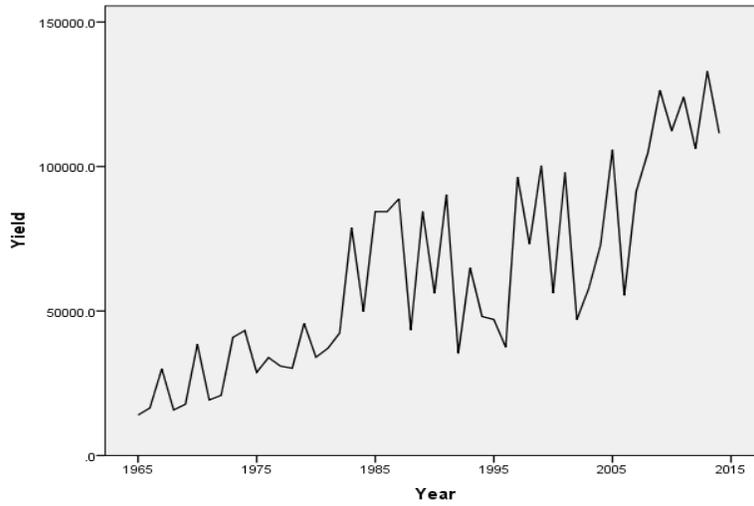Figure 1: Rise of Area for Production of Turmeric Crop in Telangana Region

Figure 2: Rise of Yield Per Year for Turmeric Crop in Telangana Region
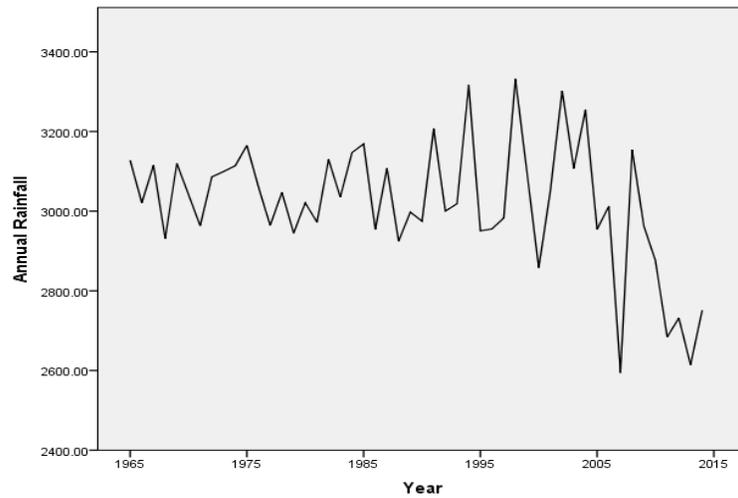

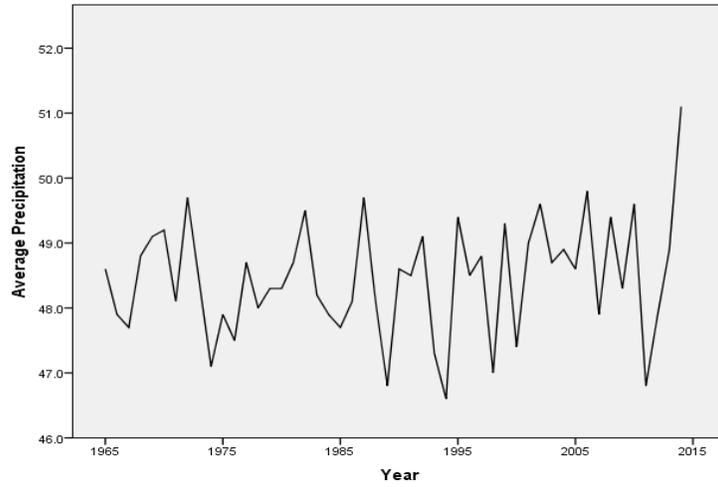Figure 3: Average Annual Rainfall in Telengana Region from 1965-2014

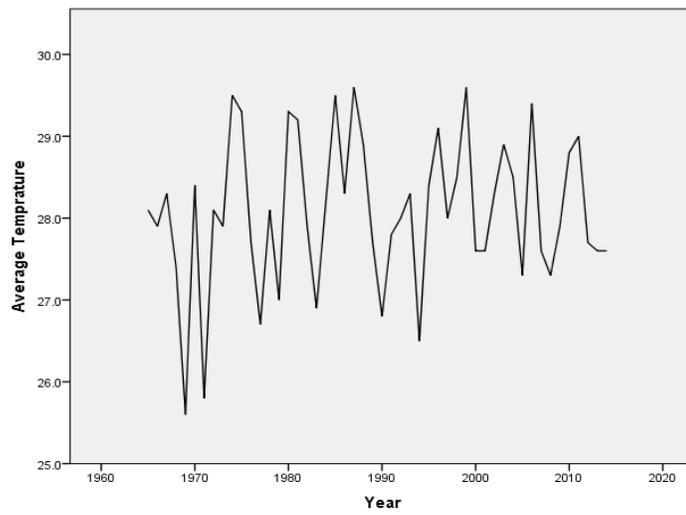Figure 4: Average Precipitation in Telengana Region from 1965-2014

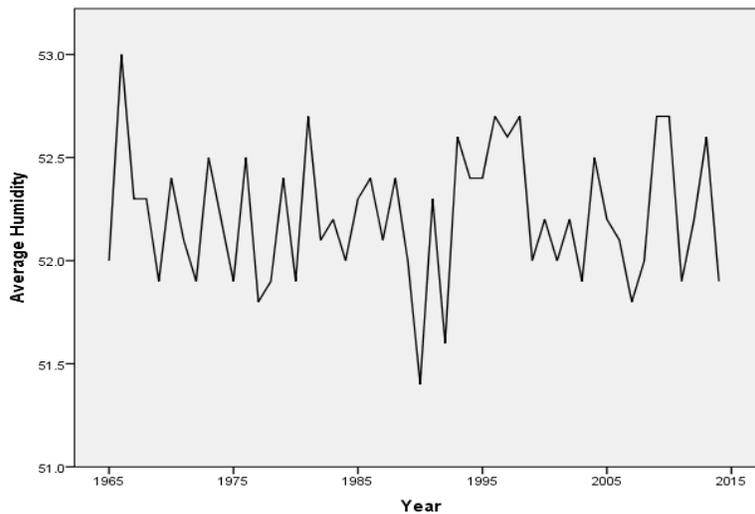Figure 5: Average Annual Temperature Per Year in Telengana Region from 1965-2014

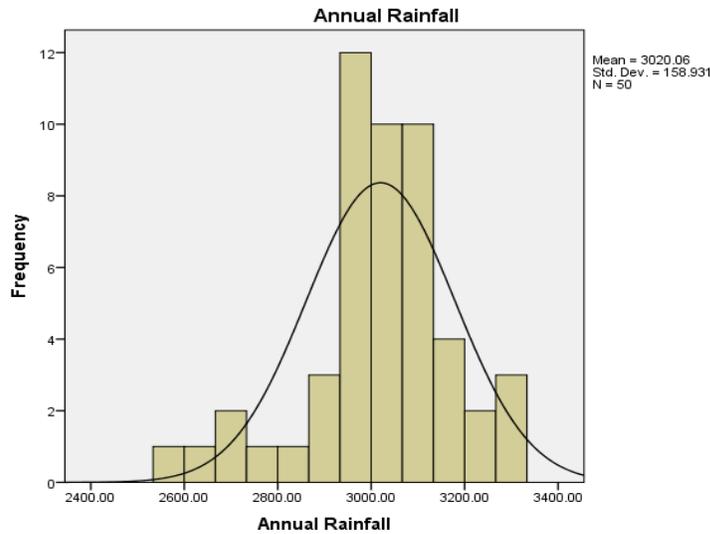Figure 6: Average Annual Humidity per Year in Telengana Region from 1965-2014

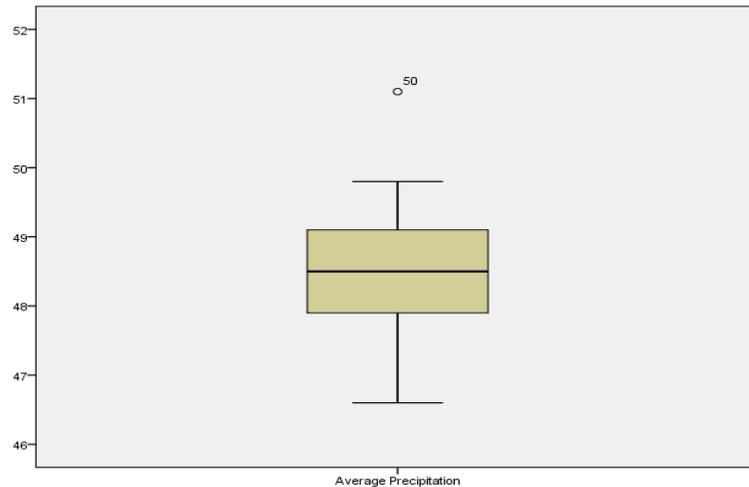Figure 7: Frequency Distribution of Annual Rainfall Over the Years in the Data Set

Figure 8: Box Plot based Analysis of Average Precipitation Over the Years

V. Regression Analysis

In regression evaluation, one seeks to degree the statistical association between two variables, X and Y. Regression evaluation is normally used to measure how changes in the independent variable, X, impact changes in the dependent variable, Y. Regression analysis shows a statistical affiliation or correlation amongst variables, rather than a causal dating amongst variables.

The case of simple, linear, least squares regression may be written in the form

$$Y = \alpha + \beta X + \varepsilon_1$$

Where Y, the structured variable, is a linear characteristic of X, the independent variable. The parameters α and β symbolize the populace regression line and e is the randomly allotted blunders time period. The regression estimates of a and b might be derived from the precept of least squares. In applying least squares, the sum of the squared regression errors can be minimized; our regression mistakes identical the real based variable minus the expected price from the regression line. If Y represents the actual price and Y the anticipated fee, then their distinction is the mistake term, e. Least squares regression minimized the sum of the squared blunders phrases. The easy regression line will yield an estimated fee of Y, ^ Y, by the usage of the pattern regression:

$$\hat{Y} = a + \beta X$$

In the estimation, a is the least squares estimate of a and b is the estimate of β Regression Analysis and Forecasting Models
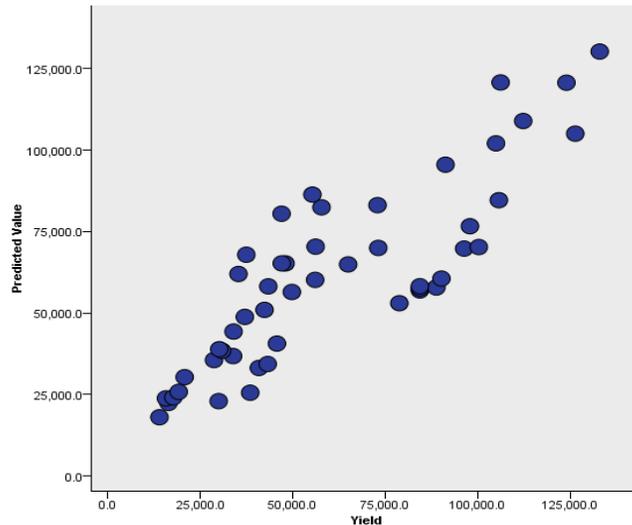

Figure 9: Regression based Prediction Model of Turmeric Yield showing Linear Relationship However with a Lot of Outliers

VI.   Conclusions

Gauge of yield generation before harvests are required for carport, evaluating, promoting, import, fare et cetera. The critical components influencing crop yield is atmosphere. Climate changeability causes the misfortunes in the yield. Utilization of climate canbe improved the situation trim assembling estimate. Climate assumes a basic part in edit development. Thusly form basically in light of climate parameters can give tried and true estimate before to trim yield. A factual form is utilized for edit yield conjecture at stand-out blast in wheat trim. This form utilize, most extreme and least temperature, precipitation, morning and night relative moistness over the span of harvest developing period and shutting thirty a year yield records of that product. This model is direct, does not required any refined factual apparatus, required most straightforward climate insights for edit developing terms, yield data for past thirty a year and bears right pre reap conjecture. In this manner it could be utilized for area, agro climatic zone and kingdom organize conjecture. It has been discovered that relapses fundamentally in light of various subsets of data create exceptionally uncommon results, raising inquiries of rendition solidness. Much of the time, we do never again include appropriate measurements inside the experience that missteps are non-ordinary or the difference is non-homogeneous. The insights may contain exceptions or extremes which aren't easily discernible however genuinely powerful as the minimum squares estimation system tends to drag the imagined relapse reaction towards distant perceptions. The variable pool won't consolidate the correct factors inside the privilege utilitarian administration and we may moreover have secured factors with a high recognition of multi-collinearity. In Our Future works we can center around counterfeit neural group based strategy to conjecture yield of the Turmeric edit we can gives a gainful understanding into the capacities of neural systems and their factual inverse numbers utilized as a part of the area of forecast of product yield. We can give similar investigate various assortments of NN based anticipating models so our strategy is to acknowledgment on looking at the exhibitions of existing designs that have been completed to estimating, set up of presenting new guaging styles.

References

[1]   Challinor, A.J., Slingo, J.M., Wheeler, T.R. and Doblas–Reyes, F.J. Probabilistic simulations of crop yield over western India using the DEMETER seasonal hindcast ensembles. Tellus A **57** (3) (2005) 498-512.
[2]   The State of Food and Agriculture, Fao.org, 2002.
[3]   Rosegrant, M.W., Ringler, C., Msangi, S., Sulser, T.B., Zhu, T. and Cline, S.A. International model for policy analysis of agricultural commodities and trade (IMPACT): model description. *International Food Policy Research Institute (IFPRI)*, 2012.
[4]   Boote, K.J., Jones, J.W. and Pickering, N.B. Potential uses and limitations of crop models. *Agronomy Journal* **88** (5) (1996) 704-716.

[5]   Oerke, E.C., Dehne, H.W., Schönbeck, F. and Weber, A. Crop production and crop protection: estimated losses in major food and cash crops. *Elsevier*, 2012.
[6]   Turmeric. En.wikipedia.org. Retrieved 10 April 2018, from https://en.wikipedia.org/wiki/Turmeric
[7]   Sass, C., Iles, W.J., Barrett, C.F., Smith, S.Y. and Specht, C.D. Revisiting the Zingiberales: using multiplexed exon capture to resolve ancient and recent phylogenetic splits in a charismatic plant lineage. *PeerJ* ., **4** (2016) e1584.
[8]   Anon, Agriexchange.apeda.gov.in.
[9]   Liu, B., Liu, L., Asseng, S., Zou, X., Li, J. and Cao, W. Modelling the effects of heat stress on post-heading durations in wheat: A comparison of temperature response routines. *Agricultural and forest meteorology* **222** (2016) 45-58.
[10]   Mathieu, J.A. and Aires, F. Statistical Weather-Impact Models: An Application of Neural Networks and Mixed Effects for Corn Production over the United States. *Journal of Applied Meteorology and Climatology* **55** (11) (2016) 2509-2527.