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Fitting of the distribution for CV value of the cotton and tobacco experiment

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Abstract
Coefficient of variation (CV) was a measure commonly applied to present variation in agricultural experiments. Its merits are well known, most important being one that CV deals with what we could call the scale-invariant variability in the experiments. It was easier to understand than variance it was based upon. Coefficient of variation used to compare the variation of traits in two (or more) populations or, more commonly, the variation of different traits in a population of the study. If the CV was within certain limits one can say that block has homogeneity in the character under study. Conditional on which distribution was to be used for modelling of the CV data of an experiment, which was a common problem in agricultural science. The six distributions *viz*., Normal, Lognormal, Gamma, Weibull, Exponential and Beta used for the fitting of distribution study. The test statistic Kolmogorov-Smirnov test, Cramer-Von-Mises test, Anderson-Darling test and Chi-Square test for each data set was computed for six probability distributions and used to identify the best-fit distribution. The probability distributions *viz*., Normal, Lognormal, Gamma, Beta, Weibull, Exponential were identifying to evaluate the best-fit probability distribution for CV value. In addition, the different forms of these distributions also tried and thus the probability distributions applied to find out the best-fit probability distribution and to know the nature and shape of the distribution.

Keywords: Anderson-darling test, beta, chi-square test, cramer-von-mises test, exponential, gamma, kolmogorov-smirnov test, lognormal normal, weibull

1. Introduction
Agriculture is the most important sector of Indian Economy. It accounts for 18 per cent of India's gross domestic product (GDP) and provides employment to more than 50% of the country's workforce. India was the world's largest producer of milk, pulses and jute, and ranks as the second - largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It was also one of the leading producers of spices, fish, poultry, livestock and plantation crops. For getting, more agricultural production and productivity agricultural research system play an important role. India has one of the largest and institutionally most complex agricultural research systems in the world. With Indian Council of Agricultural Research (ICAR) at the top, we have 65 Institutes including 4 Deemed Universities, 6 National Bureau, 13 Project Directorates, 14 National Research Centre's, 158 Regional Stations and 60 All India Coordinated Research Projects. In agriculture, large numbers of experiments conducted at various research stations to test the effects of the treatments on growth and yield parameters of field crops and their effects on soil productivity. The results of such experiments are influenced by several factors requiring some index to judge the reliability of the results. In addition, one has to use the criterion of homogeneity for forming the blocks and for this purpose; CV used as a tool.

Coefficient of variation (CV) was a measure commonly applied to present variation in agricultural traits. Its merits are well known, most important being one that CV deals with what we could call the scale-invariant variability in the traits. It was easier to understand than variance it was based upon. Coefficient of variation used to compare the variation of a trait in two (or more) populations or, more commonly, the variation of different traits in a population of the study. If the CV was within certain limits one can say that block has homogeneity in the character under study. To obtain such limits *i.e.*, to obtain confidence limits for the necessary important parameter. The study of such a confidence interval carried out for the distribution, which was fitting to the given data through the CV. Thus, for the reliability of the results of the field experiments the analysis of CV was necessary. Depending on which distribution was to be use for modelling of the CV data of an experiment, which was a common problem in agricultural science.

Distribution of CV was also having a high peak and long tail. Patel *et al*. (2010) [20] discuss the method of fitting lognormal distribution to CV data of mustard crop experiments. Given a need to allow for, skewness and all unimodal distribution it has become interesting to study frameworks that are flexible enough to accommodate distributions with a broad range of properties. In most cases, need to fit two or more distributions to compare the results and select the most valid model. In the present study data for more than 10 years on cotton and tobacco crops received from long-term crop experiments of different Research Stations of State Agricultural Universities have used and tried to fit distributions like Normal, Lognormal, Gamma, Weibull, Exponential, and Beta.

2. Materials and Methods
2.1 Database
The CV values for yield character (secondary data) of experiments conducted on different crops at different research stations of Gujarat Agricultural University (GAU) was collected from the reports of research stations for this study.

Experimental data for CV value of different crops

Crops/Group of crops	No. of experiments	Year
Cotton	1786	1990 – 2000 (15 Year)
Tobacco	544	1980 – 1993 (14 year)

2.2 Methodology
The following six distributions *viz*., Normal, Lognormal, Gamma, Weibull, Exponential and Beta used for the fitting of distribution (Gupta and Kapoor, 2016). Statistical software SAS was used for the purpose of fitting distribution on CV data for the present study.

2.2.1 Normal Distribution (C. F. Gauss, 1809) [12].
The Normal distribution first discovered in 1733 by English mathematician De-Moivre. A random variable X said to have a Normal distribution with parameters μ (mean) and σ^2 (variance) if its p. d. f. given by the probability law:

$$f(x)=\frac{1}{\sqrt{2\Pi\sigma^2}}\exp^{-\frac{1}{2\sigma^2}.(x-\mu)^2} \quad = 0, \quad \text{otherwise}$$

The first-row moment (μ_1) = mean (μ), second-row moment (μ_2) = σ^2, third-row moment (μ_3) = 0, fourth-row moment $(\mu_4) = 3\mu_2^2$, measure of skewness, $\beta_1 = \frac{\mu_3^2}{\mu_2^3}$, measure of kurtosis, $\beta_2 = \frac{\mu_4}{\mu_2^2}$.

2.2.2 Lognormal Distribution (C. C. Heyde, 1963) [17].
The positive random variable X said to have a Log-normal distribution if $logeX$ was normally distributed

$$f(u) = \frac{1}{u\sigma\sqrt{2\pi}}\, exp\left\{-\frac{(\log u-\mu)^2}{2\sigma^2}\right\}, u > 0 = 0, u \le 0$$

The first-row moment $(\mu_1) = \alpha e^{\sigma^2/2}$ mean (μ), second-row moment $(\mu_2) = \alpha^2 e^{\sigma^2}(e^{\sigma^2} - 1)$.

2.2.3 Weibull Distribution (Waloddi Weibull, 1951) [28].
A continuous random variable X has a Weibull distribution with parameter c (>0), α (>0), and μ if it p. d. f. was:

$$f(x) = \frac{c}{\alpha}\left(\frac{x-\mu}{\alpha}\right)^{c-1}\exp\{-(\frac{x-\mu}{\alpha})^{c}\}\ ; x > \mu, c > 0$$

The first-row moment $(\mu_1) = \Gamma\left(\frac{1}{c}+1\right)$ mean (μ), second-row moment $(\mu_2) = \Gamma\left(\frac{2}{c}+1\right) - [\,\Gamma\left(\frac{2}{c}+1\right)]^2$.

2.2.4 Exponential Distribution (A. Elfessi and D. M. Reineke, 2001) [10].
A random variable X said to have an Exponential distribution with parameter θ >0, if its p. d. f. was given by:

$$f(x) = \theta\left(e^{-\theta x}\right), x \ge 0 = 0, \text{otherwise}$$

The first-row moment $(\mu_1) = \frac{1}{\theta}$ mean (μ), second-row moment $(\mu_2) = \frac{1}{\theta^2}$.

2.2.5 Beta Distribution (R. J. Beckman and G. L. Tietjen, 1978) [4].
A random variable X said to have a Beta distribution of first kind with parameters μ and ν [(μ, ν) > 0] if its p. d. f. was given by;

$$f(x) = \frac{1}{B(\mu,\nu)}x^{\mu-1}(1-x)^{\nu-1};(\mu,\nu)>0, 0<x<1 = 0, \text{otherwise}$$

The first row moment $(\mu_1) = \frac{\mu}{\mu+v}$, second-row moment $(\mu_2) = \frac{\mu v}{(\mu+v)^2(\mu+v+1)}$ third-row moment $(\mu_3) = \frac{2\mu v\,(v-\mu)}{(\mu+v)^3\,(\mu+v+1)\,(\mu+v+2)}$, fourth-row moment $(\mu_4) = \frac{3\mu v\{\mu v\,(\mu+v-6)+2\,(\mu+v)^2\}}{(\mu+v)^4(\mu+v+1)(\mu+v+2)(\mu+v+3)}$, measure of skewness $\beta_1 = \frac{4(v-\mu)^2(\mu+v+1)}{\mu v(\mu+v+2)^2}$, measure of kurtosis $\beta_2 = \frac{3(\mu+v+1)\mu v(\mu+v-6)+2(\mu+v)^2}{\mu v(\mu+v+2)(\mu+v+3)}$.

2.2.6 Gamma Distribution (J. A. Greenwood and D. Durand, 1960) [13].
A random variable X said to have a Gamma distribution with parameter λ > 0, if its p. d. f. given by:

$$f(x) = \frac{e^{-x}x^{\lambda-1}}{\Gamma(\lambda)}\ ;\ \lambda > 0,\ 0 < x < \infty = 0, \text{otherwise}$$

The first row moment $(\mu_1) = \lambda$, mean (μ), second-row moment $(\mu_2) = \lambda$, third-row moment $(\mu_3) = 2\lambda$, fourth-row moment $(\mu_4) = 3\lambda$, measure of skewness $\beta_1 = \frac{4}{\lambda}$, measure of kurtosis $\beta_2 = 3 + \frac{6}{\lambda}$.

2.2.7 Statistical Test for Distribution Fitting
Test of goodness of fit
Establishing a best-fit probability distribution for different parameters has long been a topic of interest in the field of agriculture. The investigation of parametric distribution strongly depends upon their distribution pattern. The present study planned to identify the best-fit probability distribution based on the distribution pattern for different data set. The six-probability distribution are select out of large number of commonly used probability distribution for such type of study. The descriptive statistics computed first for each weather parameters for different study periods. The test statistics computed for all six-probability distribution.
The best-fit probability distribution identified based on highest ranks computed through all the four tests

independently. The best-fit probability distribution so obtained were presented with their test statistic value in each study period. It was further weight using highest scores of the selected probability distribution for each study period. The combination of total test score of all the four test statistics was computed for all the six probability distributions. Finally, the best fit probability distribution for CV value of field experiments was identified help of chi-square, Kolmogorov-Sminrov, Anderson-Darling and Cramér-von Mises test.

3. Results and Discussion

3.1 Statistical Analysis

The four goodness of fit test *viz*. Kolmogorov-Smirnov test, Cramer-Von-Mises test, Anderson-Darling test and Chi-Square test used fitted to distribution on CV value. The test statistic was computed and tested at (α=0.05) level of significance for each distribution. The assessments of all the probability distribution made on the bases of total test statistics obtained by combining the entire four tests. The tests statistic value of the entire four tests used to identify the best-fit distribution. Finally, the best-fit probability distributions for CV value on different sets of data were obtained and the best-fit distribution for each set of data was identify. Similar study was also reported by Gupta and Kundu (1999), Bhagat and Patil (2014) for best-fitted distribution on CV value. The results of all the distributions fitted to four crops are mention below:

3.2 Experiments on Cotton

The information of 1786 experiments conducted on Cotton crop yield at the Main Cotton Research Station, Surat and other Research Stations of the Gujarat Agricultural University during 1990-91 to 1999-2000 applied for fitting the distribution of CV. The frequency distribution of CV is presented in Fig.1, 2, and 3. Skewness coefficient found 2.01 and tail of histogram more elongated towards the right side, indicating positively skewed distribution. The data fitted to Normal, Log normal, Exponential, Gamma, Beta and Weibull distributions and parameters estimated. All four goodness of tests found significant for Normal, Exponential, Weibull, Beta and Gamma distribution and test statistics has given in Table 1, 3, 4, 5 and 6 respectively. The goodness of fit test in Lognormal distribution is presented in Table 2. Kolmogorov-Smirnov test, Cramer-Von-Mises test, Anderson-Darling test and Chi-Square test were found non-significant indicated that the Lognormal distribution was considered to be the best fit to the data of CV values of field experiments conducted on cotton crop.

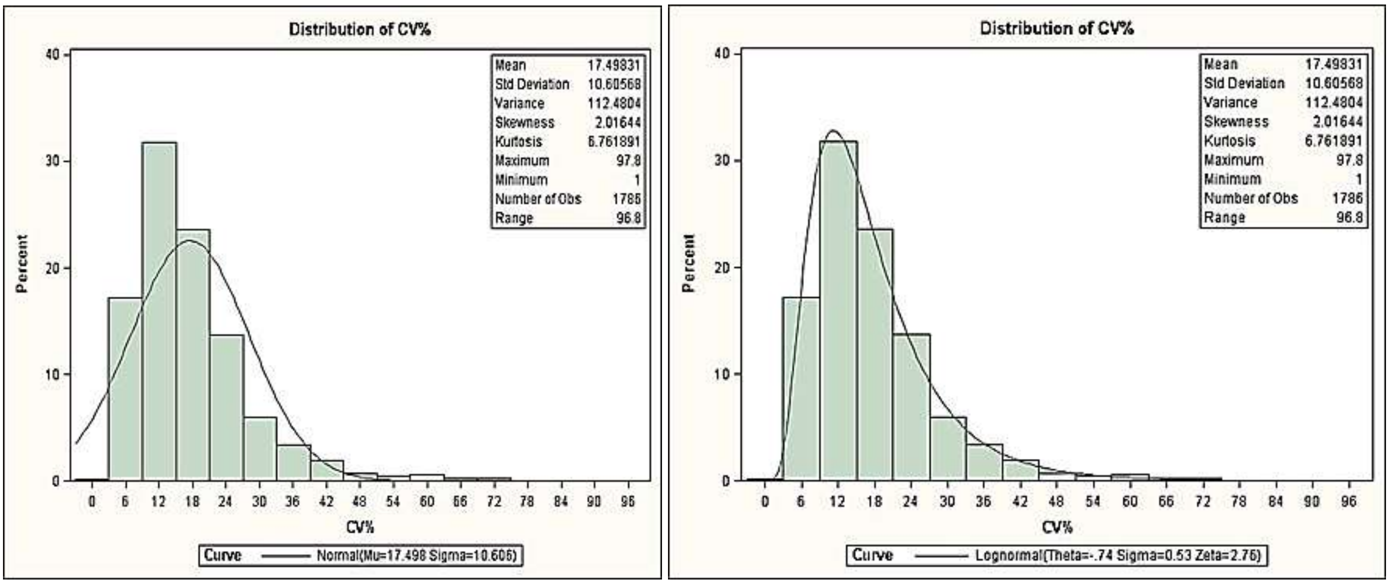

Fig 1: Fitting Normal and Lognormal distribution of CV for cotton yield

Table 1: Goodness-of-fit tests for Normal distribution of cotton yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.11		Pr > D	< 0.010
Cramer-von Mises	W-Sq	9.15		Pr > W-Sq	< 0.005
Anderson-Darling	A-Sq	55.73		Pr > A-Sq	< 0.005
Chi-Square	Chi-Sq	38096.60	14	Pr > Chi-Sq	< 0.001

Table 2: Goodness-of-fit tests for Lognormal distribution of cotton yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.01		Pr > D	> 0.500
Cramer-von Mises	W-Sq	0.04		Pr > W-Sq	> 0.500
Anderson-Darling	A-Sq	0.32		Pr > A-Sq	> 0.250
Chi-Square	Chi-Sq	17.60	13	Pr > Chi-Sq	0.173

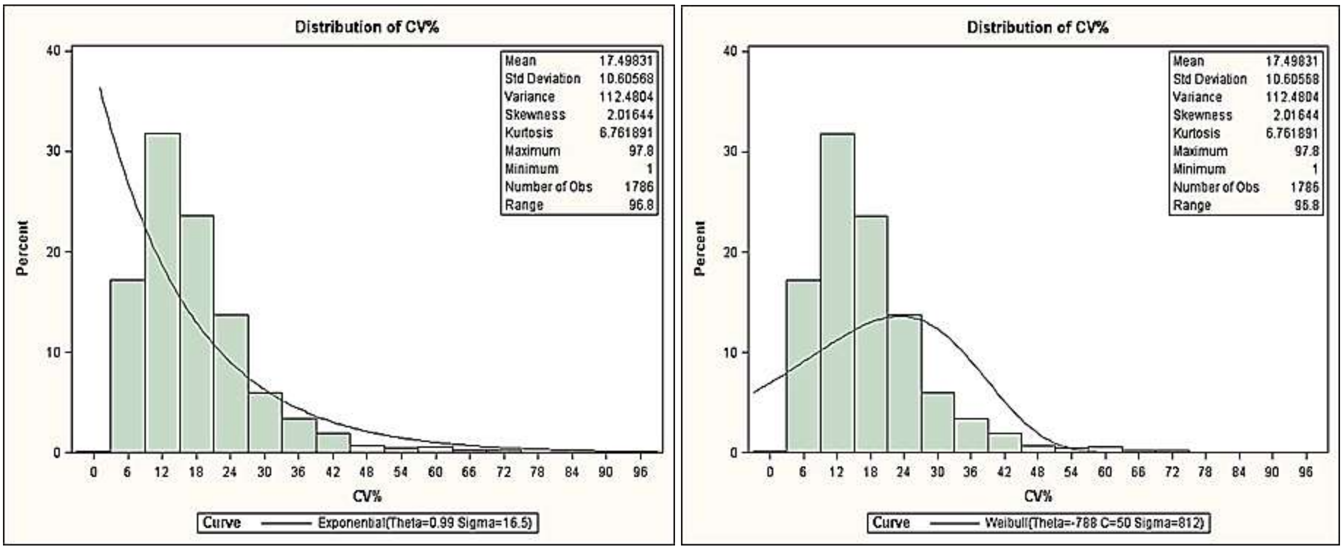

Fig 2: Fitting Exponential and Weibull distribution of CV for cotton yield

3.3 Experiments on Tobacco

The data are fitting to Normal, Lognormal, Exponential; Gamma, Beta and Weibull distribution and parameters has estimated. The descriptive statistics were given of distribution of CV was presented in Fig. 7, 8, 9, 10, 11 and 12. The plotted graph of the data showed positively skewed distribution.

Table 3: Goodness-of-fit tests for Exponential distribution of cotton yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.22		Pr > D	< 0.001
Cramer-von Mises	W-Sq	28.52		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	155.48		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	679.99	14	Pr > Chi-Sq	< 0.001

Table 4: Goodness-of-fit tests for Weibull distribution of cotton yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.25		Pr > D	< 0.001
Cramer-von Mises	W-Sq	31.19		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	175.48		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	40638.31	14	Pr > Chi-Sq	< 0.001

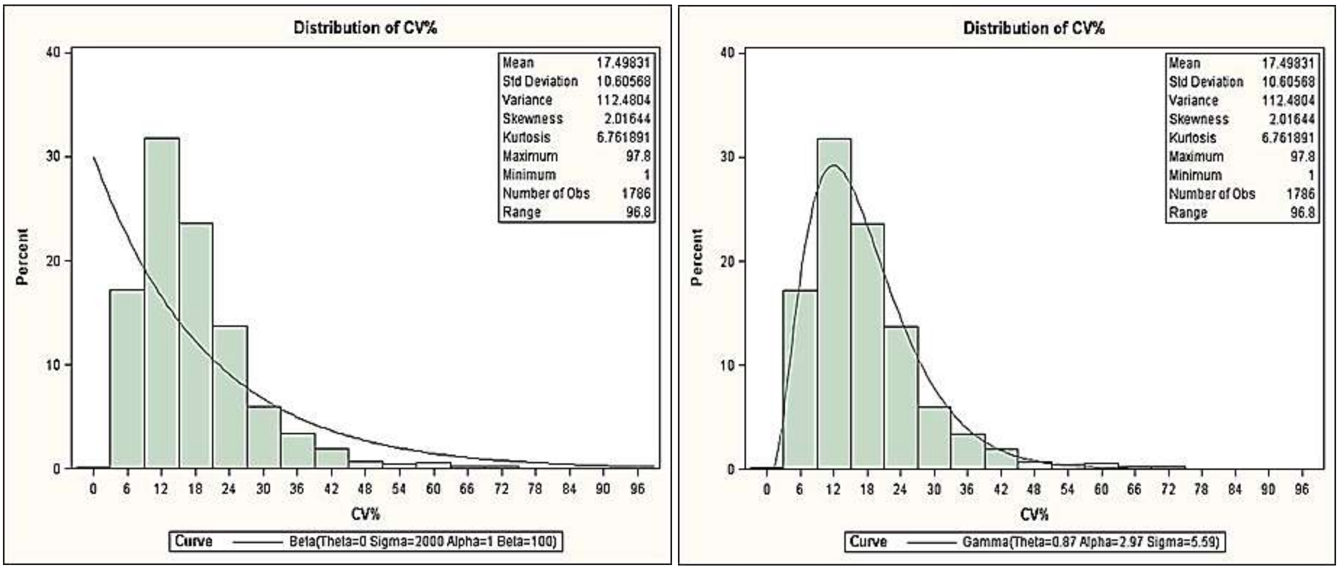

Fig 3: Fitting Beta and Gamma distribution of CV for cotton yield

Table 5: Goodness- of-fit tests for Beta distribution of cotton yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.21		Pr > D	< 0.001
Cramer-von Mises	W-Sq	26.48		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	155.58		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	862.14	16	Pr > Chi-Sq	< 0.001

Table 6: Goodness-of-fit tests for Gamma distribution of cotton yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.03		Pr > D	< 0.001
Cramer-von Mises	W-Sq	0.70		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	4.54		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	190.08	13	Pr > Chi-Sq	< 0.001

The test statistic Kolmogorov-Smirnov test, Cramer-Von-Mises test, Anderson-Darling test and Chi-Square test for each data set computed for six probability distribution. All four tests were significant at < 5 percent level of significance except Lognormal and Gamma distribution for which tests were non-significance (Table 4.44 and 4.48). Lognormal (Table 8) distribution having a higher level of significance as compared to Gamma distribution indicating lognormal distribution fits well in data sets.

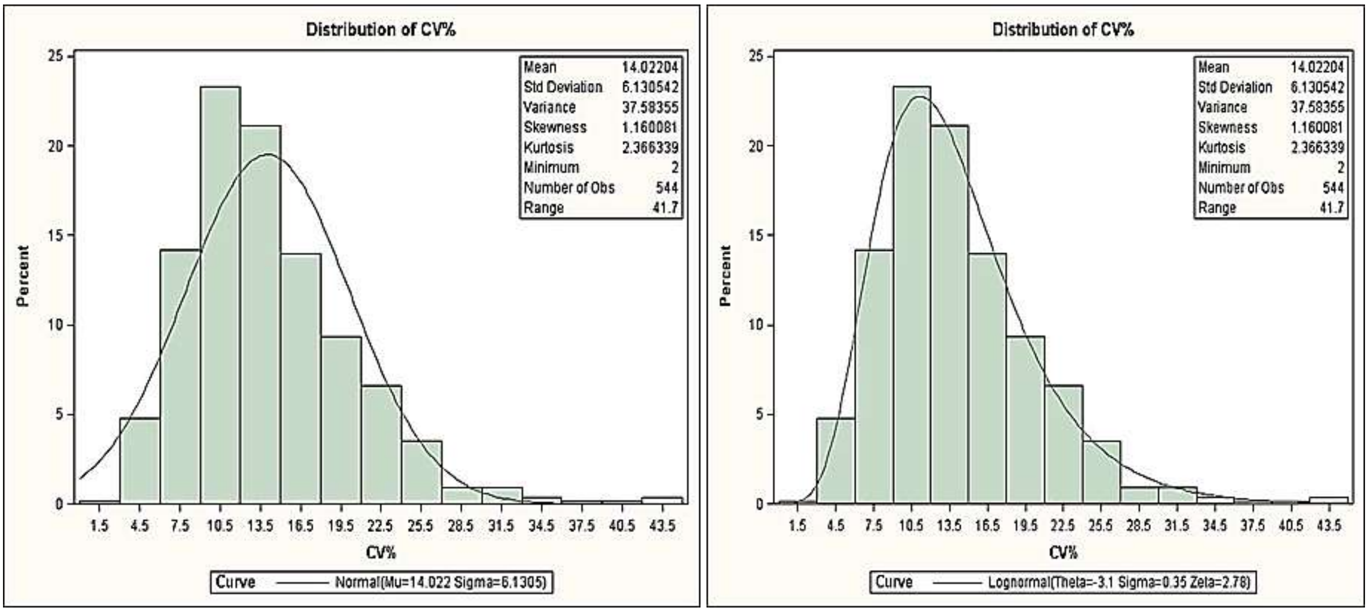

Fig 4: Fitting Normal and Lognormal distribution of CV for tobacco yield

Table 7: Goodness-of-fit tests for Normal distribution of tobacco yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.08		Pr > D	< 0.010
Cramer-von Mises	W-Sq	1.23		Pr > W-Sq	< 0.005
Anderson-Darling	A-Sq	7.23		Pr > A-Sq	< 0.005
Chi-Square	Chi-Sq	3353.06	12	Pr > Chi-Sq	< 0.001

Table 8: Goodness-of-fit tests for Lognormal distribution of tobacco yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.02		Pr > D	> 0.250
Cramer-von Mises	W-Sq	0.03		Pr > W-Sq	> 0.500
Anderson-Darling	A-Sq	0.21		Pr > A-Sq	> 0.500
Chi-Square	Chi-Sq	12.04	11	Pr > Chi-Sq	0.360

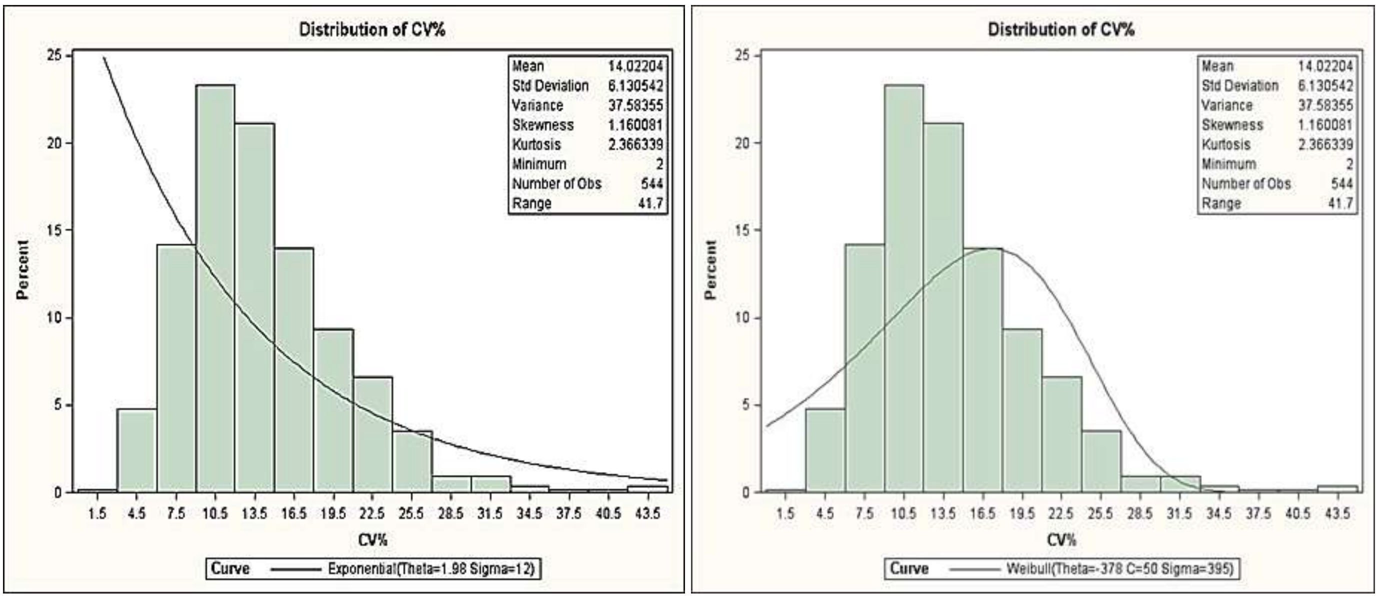

Fig 5: Fitting Exponential and Weibull distribution of CV for tobacco yield

Table 9: Goodness-of-fit tests for Exponential distribution of tobacco yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.27		Pr > D	< 0.001
Cramer-von Mises	W-Sq	12.66		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	65.57		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	310.83	12	Pr > Chi-Sq	< 0.001

Table 10: Goodness-of-fit tests for Weibull distribution of tobacco yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.16		Pr > D	< 0.001
Cramer-von Mises	W-Sq	4.85		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	29.44		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	3689.51	12	Pr > Chi-Sq	< 0.001

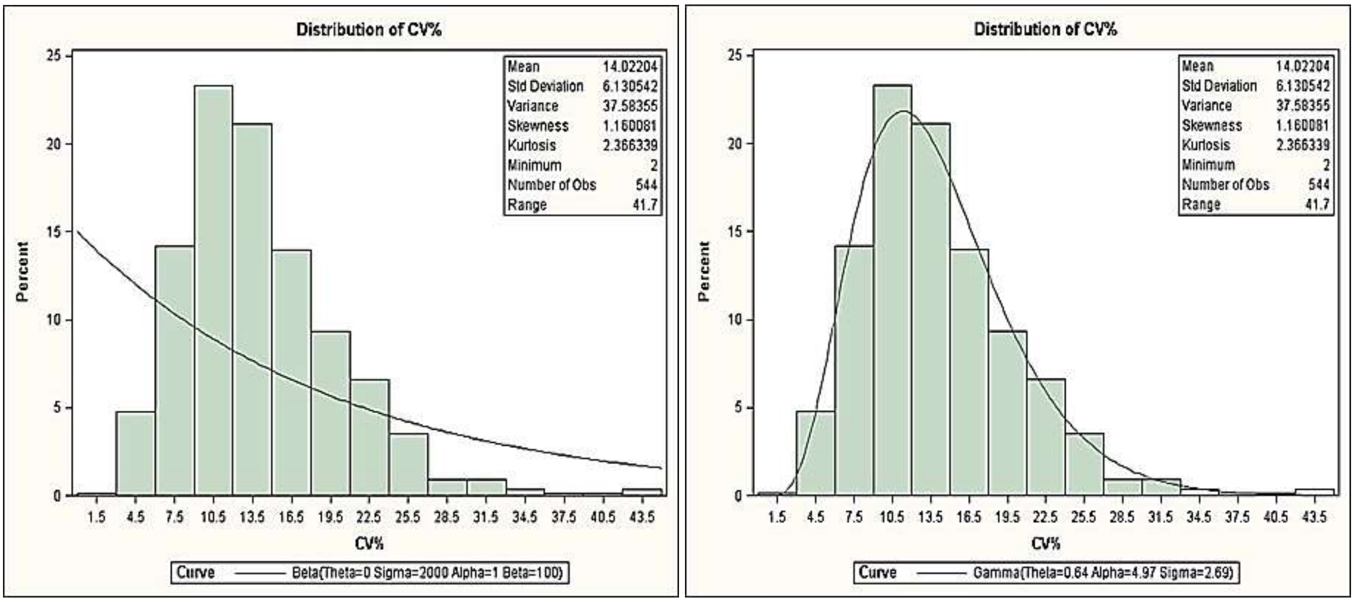

Fig 6: Fitting Beta and Gamma distribution of CV for tobacco yield

Table 11: Goodness-of-fit tests for Beta distribution of tobacco yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.24		Pr > D	< 0.001
Cramer-von Mises	W-Sq	13.08		Pr > W-Sq	< 0.001
Anderson-Darling	A-Sq	73.83		Pr > A-Sq	< 0.001
Chi-Square	Chi-Sq	477.50	14	Pr > Chi-Sq	< 0.001

Table 12: Goodness-of-fit tests for Gamma distribution of tobacco yield

Test	Statistic		DF	p Value	
Kolmogorov-Smirnov	D	0.03		Pr > D	0.142
Cramer-von Mises	W-Sq	0.08		Pr > W-Sq	0.157
Anderson-Darling	A-Sq	0.45		Pr > A-Sq	0.191
Chi-Square	Chi-Sq	22.76	11	Pr > Chi-Sq	0.190

4. Conclusion
All the six distributions considered in the study were Normal, Exponential, Weibull and Beta found poor fit for cotton and tobacco crops. Lognormal distribution found to be best suited for cotton and tobacco crops and Gamma distribution found the best fit for tobacco crop. On general, the Log Normal distribution fits well to CV of experimental data for cotton and tobacco crops.

5. References

1. Anderson TW, Darling DA. A test of goodness of fit. Journal of the American statistical association 1954;49(268):765-769.
2. Azzalini A, Capitanio A. Statistical applications of the multivariate skew normal distribution. Journal of the Royal Statistical Society: Series B (Statistical Methodology) 1999;61(3):579-602.
3. Azzalini A, Valle AD. The multivariate skew-normal distribution. Biometrika 1996;83(4):715-726.
4. Beckman RJ, Tietjen GL. Maximum likelihood estimation for the beta distribution. Journal of Statistical Computation and Simulation 1978;7(3-4):253-258.
5. Bhagat AD, Patil MA. Probability distribution functions of weekly reference crop evapotranspiration for Solapur district of Maharashtra. International Journal of Agricultural Engineering 2014;7(2):399-401.
6. Bhattacharyya M, Chaudhary A, Yadav G. Conditional value at risk estimation using Pearson's type IV distribution. European Journal of Operational Research 2008;191(2):386-397.
7. Darling DA. The Kolmogorov-Smirnov, Cramer-von Mises tests. The Annals of Mathematical Statistics 1957;28(4):823-838.
8. Deka S, Borah M, Kakaty SC. Distributions of annual maximum rainfall series of north-east India. European Water, 27(28), 3-14
9. Dikko HG, David IJ, Bakari H. Modeling the distribution of rainfall intensity using quarterly data. IOSR Journal of Mathematics 2013;9(1):11-16.
10. Elfessi A, Reineke DM. A Bayesian look at classical estimation the exponential distribution. Journal of Statistics Education 2001;9(1).
11. Eugene N, Lee C, Famoye F. Beta-normal distribution and its applications. Communications in Statistics-Theory and Methods 2002;31(4):497-512.
12. Gauss CF. *Theoria motvs corporvm coelestivm in sectionibvs conicis solem ambientivm*. Sumtibus F. Perthes et IH Besser 1809.
13. Greenwood JA, Durand D. Aids for fitting the gamma distribution by maximum likelihood. *Technometrics* 1960;2(1), 55-65.
14. Gupta R, Kundu D. Theory & methods: Generalized exponential distributions. Australian & New Zealand Journal of Statistics 1999;41(2):173-188.
15. Gupta RD, Kundu D. Exponentiated exponential family: an alternative to gamma and Weibull distributions. Biometrical Journal 2001;43(1):117-130.
16. Gupta SC, Kapoor VK. Fundamental of Mathematical Statistics. Sultan Chand & Sons (11th ed). New Delhi 1994.
17. Heyde CC. On a property of the lognormal distribution. Journal of the Royal Statistical Society: Series B (Methodological) 1963;25(2):392-393.
18. Jackson OAY. Fitting a gamma or log-normal distribution to fibre-diameter measurements on wool tops. Applied Statistics 1969;18(1):70-75.

19. Jamaludin S, Jemain AA. Fitting the statistical distributions to the daily rainfall amount in peninsular Malaysia. Journal Technology 2007;46(C):33-48.
20. Patel NP, Raykundaliya DP, Patel SR, Darji VB, Dixit SK. Confidence limits for the CV data of field experiments on mustard crop. Agricultural Science Digest 2010;30(3):230-231.
21. Pearson K. On the criterion that a given system of deviations from the probable in the case of a correlated system of variables is such that it can be reasonably supposed to have arisen from random sampling. The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science 1900;50(302):157-175.
22. Raykundaliya DP, Patel SR, Patel NP. Confidence limits for the cv data of the field experiments on wheat crop: pearson type IV distribution. International Journal of Science and Nature 2013;4(2):338-340.
23. Slocomb J, Stauffer B, Dickson KL. On Fitting the Truncated Lognormal Distribution to Species Abundance Data Using Maximum Likelihood Estimation. Ecology 1977;58(3):693-696.
24. Smirnov N. Table for estimating the goodness of fit of empirical distributions. Annals of Mathematical Statistics 1948;19(2):279-281.
25. Stedinger JR. Fitting log normal distributions to hydrologic data. Water Resources Research 1980;16(3):481-490.
26. Suhaila J, Jemain AA. Fitting daily rainfall amount in Peninsular Malaysia using several types of exponential distributions. Journal of Applied Sciences Research 2007;3(10):1027-1036.
27. Suhaila J, Jemain AA. A comparison of the rainfall patterns between stations on the East and the West coasts of Peninsular Malaysia using the smoothing model of rainfall amounts. Meteorological Applications 2009;16(3):391-401.
28. Weibull W. A statistical distribution function of wide applicability. Journal of applied mechanics 1951;18(3):293-297.
29. Zalina MD, Desa MNM, Nguyen VTA. Kassim AHM. Selecting a probability distribution for extreme rainfall series in Malaysia. Water Science and Technology 2002;45(2):63-68.