IOSR Journal of Polymer and Textile Engineering (IOSR-JPTE)
e-ISSN: 2348-019X, p-ISSN: 2348-0181, Volume 8, Issue 5 (Sep. – Oct. 2021), PP 36-45
www.iosrjournals.org

Simulation of Cotton Yarn Properties Produced in Ring Spinning System

MD. Ariful Haque[1], S.M Farhana Iqbal [2]
[1](B.Sc. in Textile Engineering (CU), M.Sc. in Textile Engineering, Department of Yarn Engineering, Bangladesh University Of Textiles, Bangladesh)
[2](Associate Professor, Department of Yarn Engineering, Bangladesh University Of Textiles, Bangladesh)
[1]arif06ctex@gmail.com, [2]s.m.farhana.iqbal@gmail.com

Abstract: *This work has generated equations based on raw cotton parameters to give ideas of the yarn quality. The raw cotton used is of African and Brazil origin. This work was carried out at factory in order to develop the equation which can easily analyze yarn quality like IPI (Imperfection Index), CSP (Count Strength Product) and also consider the raw cotton parameters such as SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage% etc. which is tested by modern testing machineries raw material tested by HVI (High Volume Instrument) and Yarn tested by Auto sorter, Evenness Tester and Lea Strength Tester. The whole process is as follows: Blow room, Carding, Drawing, Simplex, Ring Frame and Winding. In this paper we have predicted formulas which can simulate cotton yarn properties by following data analysis formula=CONSTANT+B1×X1+B2×X2+………....Bn×Xn &coefficients (R^2 and adjusted R^2) values were observed. The equation was developed using 40 Ne (Karded Woven) yarn. By using this formula, we can analyze the quality of the yarn from the testing result of raw cotton before spinning.*

Background*: Simulation is a model's process that helps depth decisions. Simulation studies are the problem findings, planning, modeling, data collection, recording, proved, accuracy, designing, analysis, conducting, reporting, execution to make problem-solving technique by the way also forms clear, right away test procedure, check and balance, profit and cost, and reach a solution. Implementing these simulations can lead to critical decisions that will reduce the process loss and waste by considering fibers parameters with predicted yarn quality parameters imperfections index and count strength product.*

Materials and Methods*: The yarn, 40Ne (Karded Woven) of six samples have been made using six mixing ratios of African cotton of Mali, Cameroon, Burkina Faso, Ivory Coast and Brazil . SCI (Spinning Consistency Index) values are 131.5, 126,127,122.5, 126.9, and 127.4; UHML (Upper Half Mean Length in mm) values are 29.4, 28.44, 28.32, 28.30, 28.61, and 28.66,UI (Uniformity Index %) values are 82.1, 81.70, 81.53, 81.43, 81.81, 81.82,Wastage (%) total in process values are (15-17)%.Work has been done on SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) & Wastage% for the determination of IPI (Imperfection Index) and CSP (Count Strength Product). Raw material tested by HVI (High Volume Instrument) and Yarn tested by Auto sorter, Evenness Tester and Lea Strength Tester. Data collection, statistical analysis of implementation and preparation of the report and overview of the formula are shown following simulation.*

Results*: Dependent variables CSP (Count Strength Product) and IPI (Imperfection Index) depends on independent variables SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage% making the decision from by these simulations. It is very easy to find out the yarn quality by inputting the parameters of fiber.*

$Y(CSP) = -17241.281 + (-20.36 \times SCI) + (67.189 \times UHML) + (248.708 \times UI) + (-8.98978 \times Wastage\%)$.
Coefficients, $R^2 = 0.99978706$*, Strongly Positive Correlation.*
$Y(IPI) = 68320.936 + (-30.56368 \times SCI) + (202.016267 \times UHML) + (-803.48578 \times UI) + (-245.37163 \times Wastage\%)$.
Coefficients, $R^2 = 0.99987751$*, Strongly Positive Correlation.*

Conclusion: *Some equations have been developed and these are equations through which we can easily determine the quality of yarn from raw material properties. One way ANOVA trial method, F Value is 0.00002, the test is not significant and almost p value less than 0.05 ($P<0.05$) and p value less than 0.1 ($P<0.1$).*

Key Word*: SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index), Wastage%, Count, IPI (Imperfection Index), CSP (Count Strength Product), HVI (High Volume Instrument, Uster Evenness Tester, Autosorter etc.*

Date of Submission: 14-11-2021 Date of Acceptance: 29-11-2021

I. Introduction

Simulation is a model's process that helps depth and complex decisions. Implementing these simulations can lead to critical decisions that will reduce the process loss and waste by considering different fibers parameters with predicted yarn quality parameters imperfections index and count strength product.

Cotton is one of the strategically agricultural products that have various utilization areas in agricultural, industrial and trade sectors. Although the synthetic fiber production is increased in the world, cotton fiber remains important among other raw materials used in the world textile industry. World's 2012/2013 cotton consumption is forecasted to increase 3.6% from the last year to 106.9 million bales. China's expected mill use decline will be more than offset by consumption increases in other countries (including Bangladesh, India, Indonesia, Pakistan, Thailand, Turkey and Vietnam) [1]. Considering that, many researchers carried out interaction between fiber length and short fiber content effect on single yarn strength, yarn C.V. and yarn hairiness [2]. The relationship between raw material properties and yarn imperfections [3]. Undertake yarn strength by choosing suitable raw material and process parameters [4]. Yarn quality characteristics derived from cotton fiber properties that were measured by means of an HVI system [5]. To predict the most important yarn parameters of ring spun cotton yarns by using AFIS fibre properties, roving and yarn properties with linear multiple regression analysis [6].

Conceptualization of simulation has taken from the uster's developed equation for the SCI (Spinning Consistency Index) value is:

- 414.67 + 2.9 x Strength – 9.32 x Micronaire + 49.17 x Length (") + 4.74 x Uniformity + 0.65X Rd + 0.36 x +b. The relation among fiber properties, process controlling and yarn properties [7]. SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) are most important components of cotton fiber and wastage% are directly impact on yarn quality IPI (Imperfection Index) and CSP (Count Strength Product).The main feature of this project work is to find out the management will be able to easily knows about the quality of the yarn through these equations and take preparation based on its upside on yarn quality from the raw cotton testing result. The quality of yarn can be known in different ways by using these simulations. To accomplish this goal the following purpose set:

a) Using these simulations will reduce the process loss and waste.

b) With the help of these simulations in factories, productivity will increase on the other hand, costing will decrease.

c) It will be easy to fulfill the customer's requirement based on quality.

d) Implementing these simulations can lead to early decisions that reduce lead time.

The simulation developed in this thesis can be easily applied in factories.

UHML (Upper Half Mean Length) (Figure 1) is the very important parameter of cotton fiber because of it's directly impact on yarn quality. The variations in fiber length distributions play important roles in predicting yarn properties, such as strength and irregularity. The uniformity ratio is a measure of the length uniformity in the specimen. The higher the uniformity ratio, the more the fibers are of the same length in the specimen.

Figure 1: Optical length measurement (UHML, Short fiber) in HVI machine

From the above (Figure 1) shows that optical measurement of UHML (Upper Half Mean Length) and short fiber in HVI (High Volume Instrument).

C.S.P (Count Strength Product) is the product of English count and strength of yarn in pound. i.e. C.S.P = Count in English system x Strength of yarn in pound and is an important parameter of yarn which effect on further processing. The strength of the fabric also decreases due to the strength of the yarn.

Yarn unevenness deals with the variation in yarn fineness. IPI (Imperfection Index) means unevenness in yarn which deals Thick (+50%), Thin (-50%), Neps (+200%) in Ring Spinning system is an important parameter of yarn which effect on further processing. Shade variation of fabric occurs due to yarn unevenness.

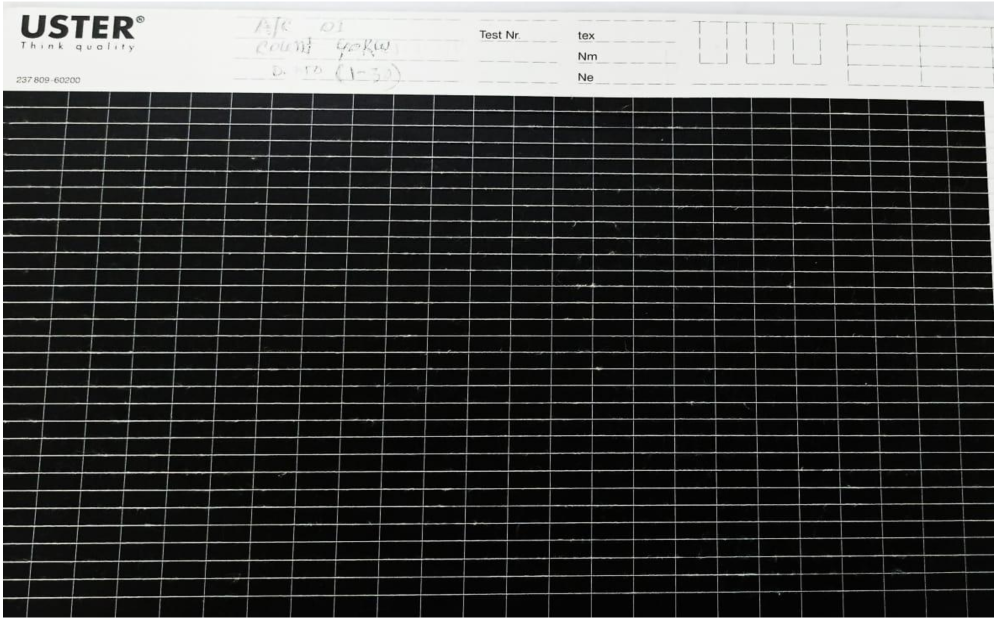

Figure 2: Thin place, Thick place and Neps.

From the above (Figure 2) shows that thin place, Thick place and Neps in the USTER black board study that is clearly shown in yarn unevenness.

Wastage% define that are Dropping-1 (4-6) %, Dropping-2 (4-5) %, Roving Waste (0.2-.5) %, AC Filter (0.3%-0.5) %, AC Dust (1.5-2.0)%, Pneumafil (2.5-3.5) %, hard wastage (0.8-1.2) %,Sweep Waste (0.4-0.6)%, Overhead waste (0.2-0.3)%, Compactor Dust (0.2-0.4)%, Wood Roller Short Fiber (0.1-0.15)%, Invisible waste (0.5-1.0) %.

II. Material And Methods

This prospective comparative study was carried out on a spinning mills ltd. from December 2019 to December 2020. The yarn, 40 Ne (Weaving Process) of six samples have been made using six mixing ratios of African cotton and Brazil cotton.

Study Location: This was a carried out at Bangladesh in the Spinning Mills Ltd.

Study Duration: December 2019 to December 2020.

Sample size: Six samples of more number of observations in a more testing sample.

Sample size calculation: The sample size was estimated on the basis of a single proportion design. The target population from which we randomly selected our sample was considered 100. The sample size actually obtained for this study was average 6 samples for each group at the different mixing ratio with different origin.

Procedure methodology

Mixing ratio of different origin Mali, Brazil, Cameroon, Burkina Faso, Ivory Coast. Different origin mixing at a ratio described by Sample A, Sample B, Sample C, Sample D, Sample E, Sample F in Table 1.

Table 1: Mixing Ratio of different origin of cotton.

Mixing Ratio	Sample
Mali-40%+Bazil-40%+Cameroon-5%+Burkina Faso-15%	Sample A
Ivory Coast-100%	Sample B
Mali-100%	Sample C
Mali-75%+Cameroon-25%	Sample D
Mali-83%+ Burkina Faso-15%+Cameroon-2%	Sample E
Mali-80%+ Burkina Faso-20%	Sample F

According to the mixing, the all parameters of the cotton have been highlighted in the Table 2.

Table 2: Ratio wise properties of Raw Cotton.

Parameters	Sample A	Sample B	Sample C	Sample D	Sample E	Sample F
SCI	131.5	126	127	122.5	126.9	127.4
Moisture (%)	6.4	5.9	6.9	6.7	6.51	6.54

MIC(µg/inch)	4.4	4.18	4.22	4.163	4.41	4.40
Maturity	0.86	0.84	0.85	0.84	0.86	0.86
Upper Half Mean Length (mm)	29.4	28.44	28.61	28.3	28.61	28.66
Uniformity Index (%)	82.1	81.70	81.53	81.43	81.81	81.82
SFI (%)	8.6	9.30	9.3	9.5	8.6	8.62
Strength (g/tex)	30.4	29.50	30.17	28.63	30.04	30.14
Elongation (%)	6.7	8.30	8.167	8.95	6.79	6.78
Reflectance (Rd)	76.2	75.1	74.03	74.7	75.24	75.26
Yellowness (+b)	9.5	8.8	10.03	9.475	10.36	10.36
Color Grade (CGrd)	25-1	31-4	32-1	31-2	22-2	22-2
TrCnt (Trash Count)	40	26	28	24.25	34.22	33.8
TrAr% (Trash Area)	0.4	0.41	0.297	0.308	30.74	29.64
TrID (Tr Grd)	3.2	3	2.3	2.8	2.83	2.8
Amt	460	489	494.3	476.8	461.3	461.6

Raw cotton is collected accordingly follow the Bale Management where numbering, grading, sorting and open the cover of compressed bales. After those bales are arranged or feed to the Blendomat line by following according to lay down chart. Chronologically feed to the Blow room line, Carding, Breaker draw frame, Finisher draw frame, Roving frame, Ring frame. Testing machines have been tested the material.

Testing atmosphere is the atmosphere in which physical test on textile materials are performed by Relative humidity: (65±2) % and Temperature: (27±2) ^{o}c. The Ambient condition of each section is presented in the Table 3.

Table 3: Ambient condition.

Description	R.H%	Temperature
Blowroom and Carding	54-58%	32-35°c
Drawing	52-55%	32-34°c
Simplex	50-55%	32-35°c
Ring	50-55%	30-34°c
Auto cone	70-72%	28-30°c

In the preparatory process, Laydown completed the opening of the fiber, heavy parts, metal parts fire are also checked, and cleaning the fiber and ejection the foreign parts and foreign fibers must be divided into two completely different groups: F (Foreign parts) and polypropylene (P) ejection have been dependent on the three-setting small, medium and large according to color wise like as violet, red, green, black, parrot, yellow in the Blow room section. Ejections/hr.: Foreign parts (F) =1500, Polypropylene (P) = 3500.

Carding is shortly described as the reduction of entangled mass of fibers where the production Speed=252 m/min, Sliver weight=70 grain/yds. Hank=0.119 Ne.

The passage to regular the sliver in the Draw frame, Doubling=8, Hank=0.119, Speed=700 m/min.

The sliver has to be reduced sufficiently in diameter to form a roving. Roving hank is used 0.925, TPI (Twist per inch) =1.10, Spacer: Beige Color (5.5 mm), Speed=1100 rpm.

Ring Spinning is the final process for cotton to yarn. The ring spinning frame developed the yarn by Count: 40 Ne, TPI (Twist per inch) =29.09, TM (Twist Multiplayer) =4.59, Average Speed: 17000 rpm, Spacer Size: (1.90 mm), Ring Traveller: 7/0 (Kanai), Back Draft: 1.28.

III. Result

The results are shown in some tables and discussion is done about obtained results, comparison with previous works, explanation to get those types of results and planning. Results are shown according to observation found. Firstly, experimental observations are described. Then various data obtained from necessary tests are shown and discussion with necessary explanation about obtained test data following as $Y=CONSTANT+B1\times X1 +B2\times X2+\ldots\ldots Bn\times Xn$.

Worked on the mixing ratio of average 6 samples for the making simulation. Simulations of CSP (Count Strength Product), SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage% are described below-

Dependent variable CSP (Count Strength Product) depends on independent variable SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage% making the decision from by this simulation. It is very easy to find out the yarn quality by inputting the parameters of fiber.

The fiber parameters of each sample and the strength of the yarn made with these samples are given in the Table 4 below.

Table no 4: Actual CSP, SCI, UHML, UI & Wastage%.

Mixing	CSP	SCI	UHML	UI	Wastage%
Sample A	2332.71	132	29.43	82.1	15
Sample B	2280.53	126	28.44	81.7	16
Sample C	2229.33	127	28.61	81.53	16
Sample D	2264.37	122.5	28.3	81.43	17
Sample E	2299.87	126.9	28.61	81.81	16
Sample F	2304.50	127.4	28.66	81.82	15
Y(CSP)=	**-17241.281+ (-20.36×SCI) + (67.189×UHML) + (248.708×UI) + (-8.98978×WASTAGE %)**				

R^2 =0.99978706 (Strongly positive correlation), Adjusted R^2=0.99893533.

Hence, the (Table 5) below shows that analysis of variance of the selected data of count strength product (CSP) and different raw cotton parameters SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage%.

Table 5: ANOVA (Analysis of Variance).

Source	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	4	6420.65565	1605.1639	1173.8234	0.021886827
Residual	1	1.36746625	1.3674662		
Total	5	6422.02311			

Hence, the (Table 6) below shows that coefficients, standard error, t Stat, P-value, Lower 95%,Upper 95% of the selected data of count strength product (CSP) and different raw cotton parameters SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage%.

Table 6: Model Coefficients of CSP, SCI, UHML, UI and Wastage%.

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-17241.281	423.963386	-40.666911	0.0156513	-22628.247	-11854.3158
SCI	-20.36	0.82768729	-24.600082	0.0258645	-30.8779394	-9.84441088
UHML	67.189	4.96812491	13.524089	0.0469875	4.06335238	130.315376
UI	248.708	5.57036979	44.648391	0.0142561	177.929790	319.486308
Wastage%	-8.98978	1.70792269	-5.2635783	0.1195236	-30.6910003	12.7114306

Difference between predictive value and actual value of count strength product (CSP) shows below (Table 7) at the different mixing ratio. Predictive value and actual value measured by the simulation formula.

Table 7: Difference of Predictive value and Actual value of CSP.

Mixing	PREDICTIVE VALUE (CSP)	ACTUAL VALUE(CSP)	Difference (±1%)
Sample A	2332.65	2332.71	0.06
Sample B	2279.82	2280.53	0.71
Sample C	2228.60	2229.33	0.73
Sample D	2265.53	2264.37	-1.16
Sample E	2300.28	2299.87	-0.41
Sample F	2304.93	2304.50	-0.43

One way ANOVA trial method, F Value is 0.00002, the test is not significant. The difference between the actual value and the predicted value of CSP (Count Strength Product) is (±1%) in each sample of mixings.

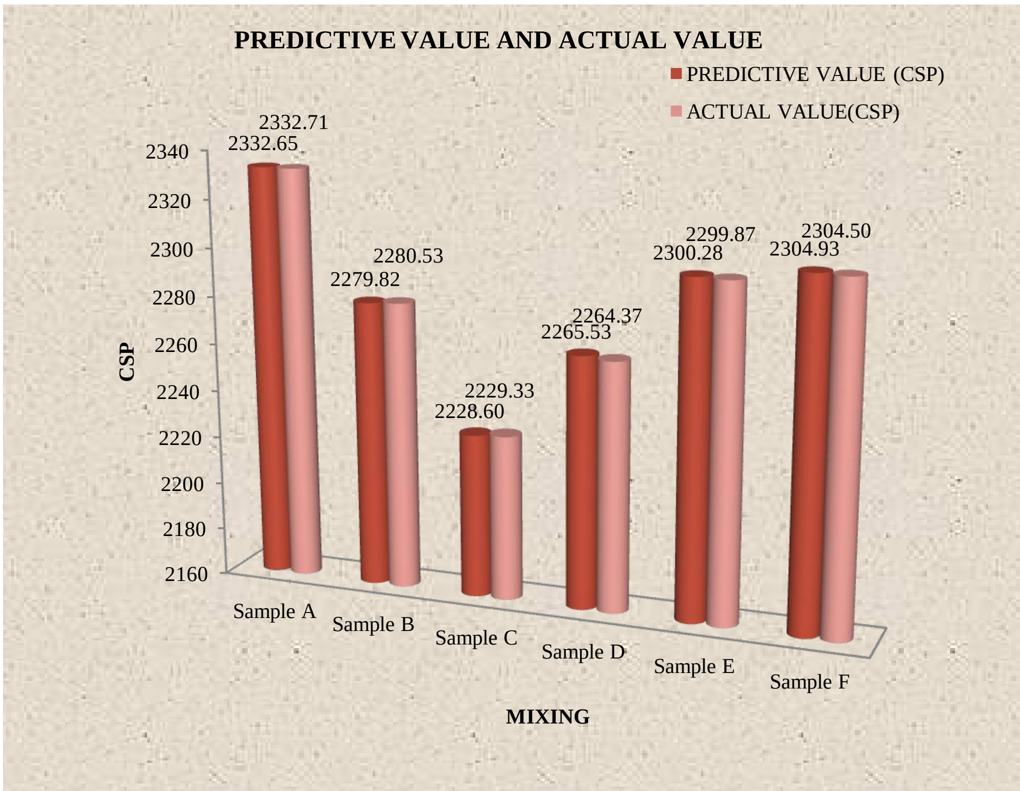

Figure 3: Difference of Predictive Value and Actual Value of CSP.

Simulations of raw cotton parameters of SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage% with yarn parameters CSP (Count Strength Product) have been made from the (Table 6) above. Raw materials parameters simulated on the CSP (Count Strength Product).

Separately discussed about the relationship between CSP (Count Strength Product) and UI (Uniformity Index). UI (Uniformity Index) directly impact on CSP (Count Strength Product). Hence, (Table 8) below shows CSP (Count Strength Product) and UI (Uniformity Index) at the different mixing ratio of the selected data.

Table 8: UI (Uniformity Index) and CSP (Count Strength Product).

Mixing	UI	CSP
Sample A	82.10	2332.71
Sample B	81.70	2280.53
Sample C	81.53	2229.33
Sample D	81.43	2264.37
Sample E	81.81	2299.87
Sample F	81.82	2304.5

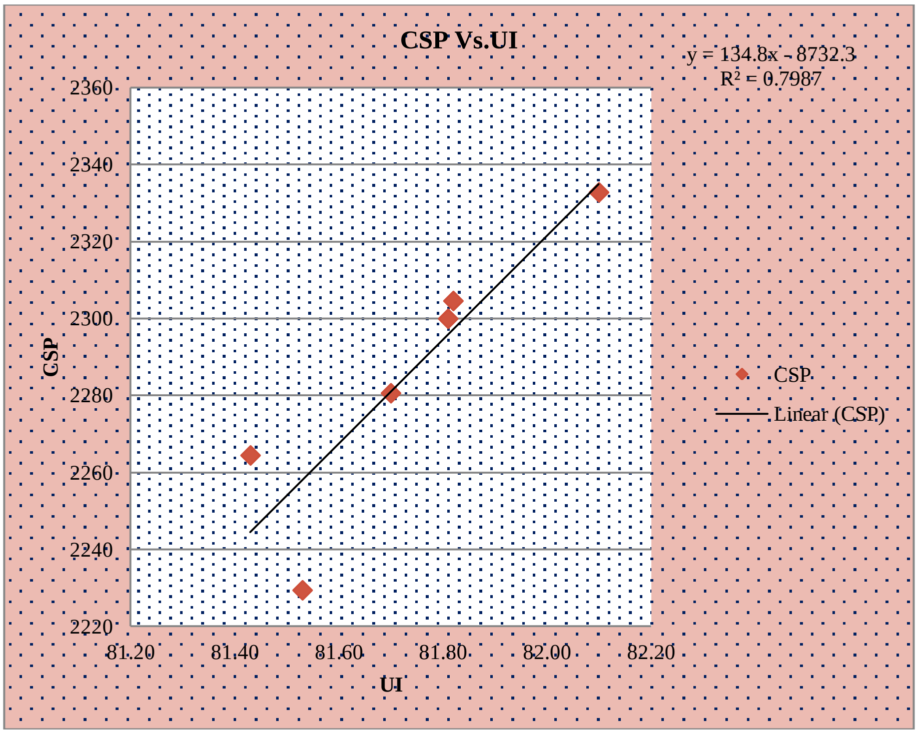

Figure 4: CSP (Count Strength Product) and UI (Uniformity Index).

Equation developed, Y= 134.8 X -8732.3. Hence, the value of R^2=0.7987 (Positive Correlation). Increase the UI increase the yarn strength and further fabric strength.

Dependent variable IPI (Imperfection Index) depends on independent variable SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage% making the decision from by this simulation. It is very easy to find out the yarn quality by inputting the parameters of fiber.

The fiber parameters of each sample and the strength of the yarn made with these samples are given in the (Table 9) below.

Table 9: IPI, SCI, UHML, UI, WASTAGE%.

Mixing No	IPI	SCI	UHML	UI	Wastage%
Sample A	585.61	132	29.43	82.1	15
Sample B	769.06	126	28.44	81.7	15.5
Sample C	782.75	127	28.61	81.53	16
Sample D	944.55	122.5	28.3	81.43	16
Sample E	563.58	126.9	28.61	81.81	16
Sample F	669.18	127.4	28.66	81.82	15.5

Y(IPI)= 68320.936+ (-30.56368×SCI) + (202.016267×UHML) + (-803.48578×UI) + (-245.37163×Wastage %)

Coefficients, R^2 =0.99987751 (Strongly Positive correlation), Adjusted R Square=0.99938756.

Hence, the table below shows that analysis of variance of the selected data of Imperfection Index (IPI) and different raw cotton parameters SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage%.

Table 10: ANOVA (Analysis of Variance).

Source	*df*	*SS*	*MS*	*F*	*Significance F*	
Regression	4	101859.5	25465	2040.777	0.0166	
Residual	1	12.47802	12.478			
Total	5	101871.9				

Hence, the (Table 11) below shows that coefficients, standard error, t Stat, P-value, Lower 95%,Upper 95% of the selected data of Imperfection Index (IPI) and different raw cotton parameters SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), UI (Uniformity Index) and Wastage%.

Table 11: Coefficients of IPI, SCI, UHML, UI and Wastage%.

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	68320.936	1392.828	49.052	0.012977	50623.37	86018.4998
SCI	-30.56368	1.956852	-15.62	0.040704	-55.4278	-5.6995227
UHML	202.016267	13.37838	15.1	0.042098	32.02778	372.004758
UI	-803.48578	17.32026	-46.39	0.013721	-1023.56	-583.411
Wastage%	-245.37163	6.991438	-35.1	0.018134	-334.206	-156.53699

Difference between predictive value and actual value of Imperfection Index (IPI)) shows below (Table 12) at the different mixing ratio. Predictive value and actual value measured by the simulation formula.

Table 12: Difference between Predictive value and Actual value of IPI (Imperfection Index).

Mixing	PREDICTIVE VALUE (IPI)	ACTUAL VALUE(IPI)	Difference (±5%)
Sample A	585.11	585.61	0.50
Sample B	767.21	769.06	1.85
Sample C	784.89	782.75	-2.14
Sample D	940.15	944.55	4.40
Sample E	562.97	563.58	0.61
Sample F	672.44	669.18	-3.26

One way ANOVA trial method, F Value is 0.00002, the test is not significant. The difference between the actual value and the predicted value of IPI (Imperfection Index) is (±5%) in each sample of mixings.

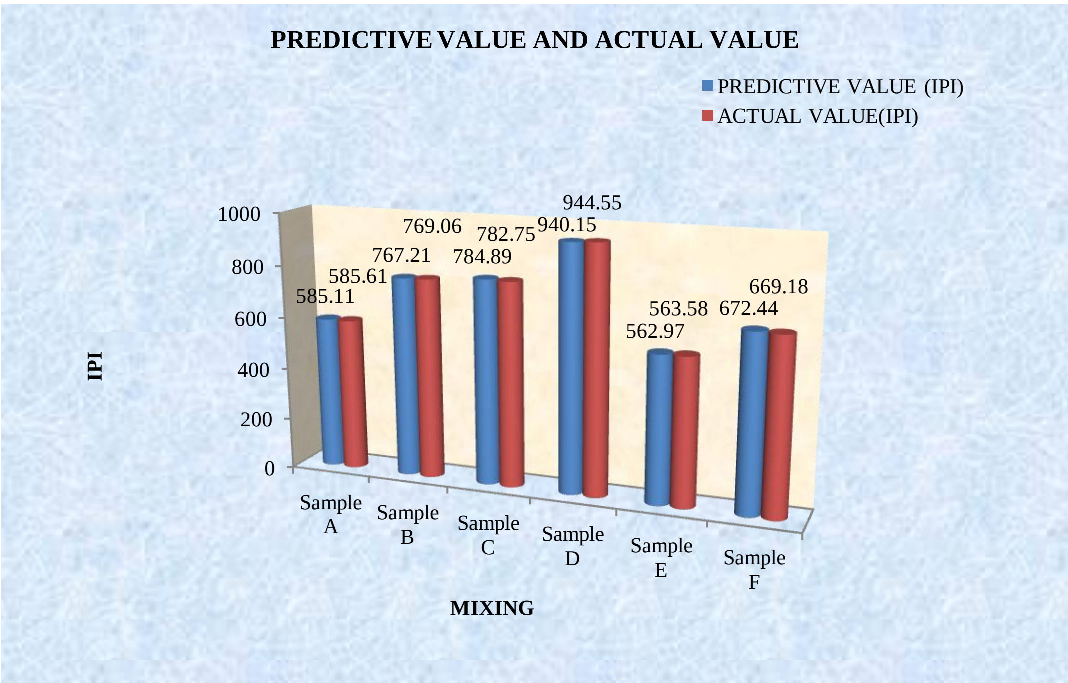

Figure 5: Difference of Predictive Value and Actual Value of IPI.

Separately discussed about the relationship between IPI (Imperfection Index) and UI (Uniformity Index). UI (Uniformity Index) directly impact on IPI (Imperfection Index). Hence, (Table below 13) shows IPI (Imperfection Index) and UI (Uniformity Index) at the different mixing ratio of the selected data.

Table 13: IPI (Imperfection Index) and UI (Uniformity Index).

Mixing	UI	IPI
Sample A	82.10	585.61
Sample B	81.70	769.06
Sample C	81.53	782.75
Sample D	81.43	944.55
Sample E	81.81	563.58
Sample F	81.82	669.18

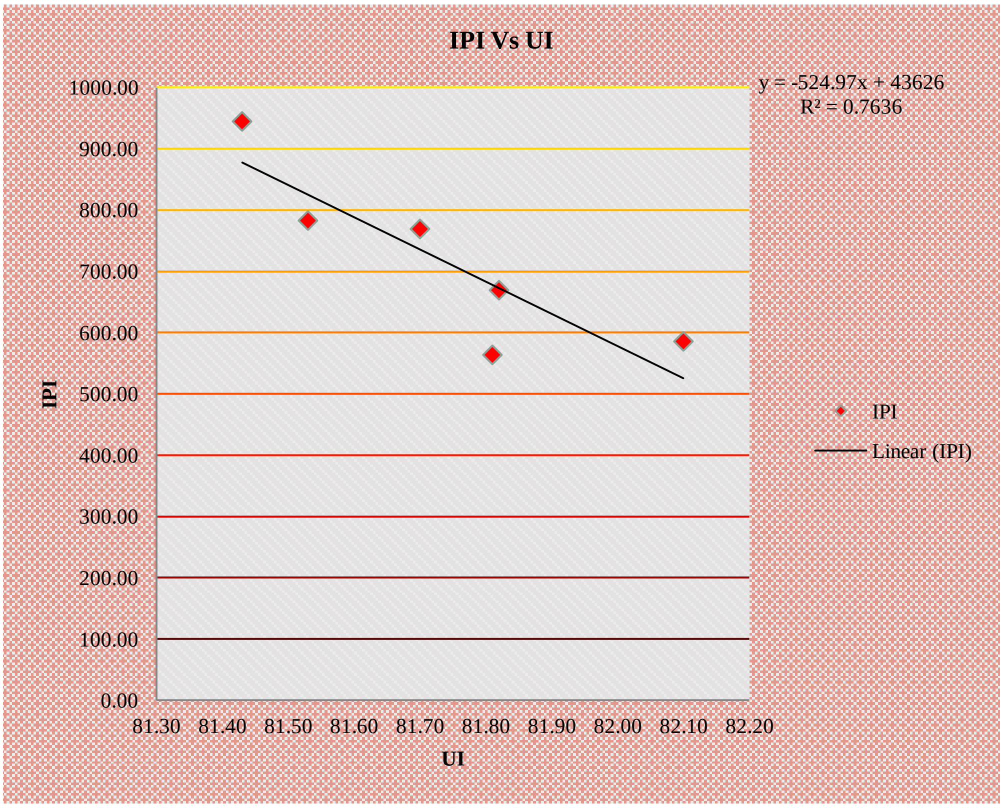

Figure 6: IPI (Imperfection Index) & UI (Uniformity Index).

Equation developed, Y= -524.97x+43626.Here the value of R^2=0.7636 (Positive Correlation). Increase the UI increase the evenness and further fabric evenness.

IV. Discussion

Simulations of raw cotton parameters of SCI (Spinning Consistency Index), and UHML (Upper Half Mean Length), and UI (Uniformity Index) and Wastage% with yarn parameters IPI (Imperfection Index) have been made. Directly impact on Raw material and wastage% simulated on the IPI (Imperfections Index) and CSP (Count Strength Product).By using these taken clear instructions about yarn parameters. Regression Statistics showing that almost p value less than 0.05 ($P<0.05$) and p value less than 0.1 ($P<0.1$).

Predictive value and actual value difference between at the minimum.Besides, UI (Uniformity Index%) , IPI(Imperfecttion Index) and CSP (Count Strength Product) developed equations.Coefficients, R^2=0.7636 (Positive Correlation) and Coefficients, R^2=0.7987 (Positive Correlation).

V. Conclusion

Through this thesis, some equations have been compiled and these are equations through which we can easily determine the quality of yarn from raw material properties. In this paper revealed some equations among yarn parameter CSP (Count Strength Product), IPI (Imperfection Index) and fiber properties SCI (Spinning

Consistency Index), UI (Uniformity Index), UHML (Upper Half Mean Length) & Wastage%. Finally, it is recommended that using these equations we can test the cotton sample and reduce the costing by making a very clear decision. These equations are if the standard parameters of spinning for weaving process are all optimum. This simulation will be very effective for the factory as it discusses waste which is very important for a factory to reduce the costing. Amazing information notice that the yarn parameters for the woven yarn will achieve the goal of achieving customer satisfaction with the simulation process of CSP (Count Strength Product), IPI (Imperfection Index) and cotton fiber parameters of SCI (Spinning Consistency Index), UI (Uniformity Index), UHML (Upper Half Mean Length) and Wastage%.

It is seen that the most important fiber properties influencing yarn evenness and strength due to their high regression coefficients. Final regression equations obtained after several analyses are represented all together adjusted R^2 is used to measure the goodness of fit in the models and statistical evaluation showed that our equations had very large R^2 and adjusted R^2 values.

Simulations of CSP (Count Strength Product), SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), and UI (Uniformity Index) & Wastage% and Simulations of IPI (Imperfection Index), SCI (Spinning Consistency Index), UHML (Upper Half Mean Length), and UI (Uniformity Index) & Wastage% are innovative to achieve goal of factory for our country. At the same time the simulation of all the parameters will be changed following the standard which is practiced in the factory.

Further research could be done on equation of various counts in knitted yarn and various fibers (natural, synthetic and blend fibers) and also fly generation in the Spinning factory.

References

[1]. T. B. Üte and H. Kadoğlu, "Regressional estimation of cotton sirospun yarn properties from fibre properties," Autex Res. J., vol. 14, no. 3, pp. 161–167, 2014, doi: 10.2478/aut-2014-0013.

[2]. I. Ibrahim, "Effect of Fiber Length and Short Fiber Percent in Cotton on Fiber and Yarn Quality," Alexandria Sci. Exch. J., vol. 39, no. OCTOBER-DECEMBER, pp. 663–668, 2018, doi: 10.21608/asejaiqjsae.2018.20692.

[3]. K. Corresp oridirig An thor.' J. Ochola, School o[Engineering, Mot Uni versi t y, Eldoret, "Study on the Influence of Fiber Properties on Yarn Imperfections in Ring Spun Yarns."

[4]. S. Das and A. Ghosh, "Cotton fibre-to-yarn engineering: A simulated annealing approach," Fibres Text. East. Eur., vol. 23, no. 3, pp. 51–53, 2015, doi: 10.5604/12303666.1152442.

[5]. M. B. Üzümcü and H. Kadoğlu, "Predicting compact yarn's IPI faults by using HVI fiber properties," IOP Conf. Ser. Mater. Sci. Eng., vol. 254, no. 16, 2017, doi: 10.1088/1757-899X/254/16/162011.

[6]. M. E. Üreyen and H. Kadoğlu, "The prediction of cotton ring yarn properties from AFIS fibre properties by using linear regression models," Fibres Text. East. Eur., vol. 15, no. 4, pp. 63–67, 2007.

[7]. E Oner et al The effect of cotton fibre characteristic on yarn properties 2018 IOP Conf. Ser.: Mater. Sci. Eng. 459 012057

MD. Ariful Haque, et. al. "Simulation of Cotton Yarn Properties Produced in Ring Spinning System." *IOSR Journal of Polymer and Textile Engineering (IOSR-JPTE)*, 08(05), 2021, pp. 36-45.