

## Investigation an impact of Weft Count and Pick densities on allied fabric properties

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### Abstract

Loom performance and fabric properties are mostly impacted by several parameters which are warp count, weft count, EPI, PPI and speed of the weaving machine. Among all the properties picks per inch and weft counts have considerable effect on cover factor, warp and weft crimp properties, fabric strength and fabric extension etc. In this research work, nine different fabric samples were prepared by using three different pick densities with three different weft yarn. The results were analyzed further, it was found that changes in PPI and weft count would leads to effect on cover factor and crimp percentage which hampers the weaving performance. It was also analyzed that picks per inch of the fabric have considerable effect on fabric strength properties. This research work would be the bench mark for the textile industry and highly beneficial for the researcher to investigate the impact of different count on the fabric properties.

**Keywords:** cover factor, crimp, EPI, PPI warp count &weft count.

### I. Introduction

Textile is an essential component and backbone of India's economy. Industrial revolution and continuous efforts in research for the development and betterment of textiles bring India to the world textile forum and recognized by the different fabric manufacturing and garment exporting countries. Textile sector is a major contributor's to India's export with 15% of total export. India's textile and clothing business once more has witnessed a downward trend within the exports phase. The exports have tumbled marginally by zero.2% to US\$ 36639.4 million (FY 2016-17) over the previous business enterprise. Thirteen of the country's total exports within the last business enterprise, wherever in 2015-16 and 2014-15, the world accounted for 14 July and twelve-tone system severally. Presently apparels square measure ruling the export basket with a forty eighth stake within the total T&C exports with a growth of 6.6% in 2016-17, which is growing rapidly and expected to reach 230 US billion dollar around 2020. [1] India's textile industries challenging the world economy exports in this competitive world. To build our position in textile world market we should focused on the export quality fabric that can be further achieved by increasing production skill practices, merchandising practices and selecting quality raw material. There are different variables of warp and weft and inefficient working of temples prone to impact on the Fabric's Shrinkage [2]. Warp count plays vital role in maintain fabric spacing therefore warp yarn should be properly sized by optimizing all sizing machine parameters viz. speed and stretch [3]. This will help to enhance the loom productivity by uniformly coating over the yarn surface [4, 5]. Picks per inch and weft count were studied in this research to show its effect on weaving performance and fabric properties. It can be useful deciding the quality and for finalizing the cost of finished fabric, export point of view [6]. There are certain characteristics of fabric which totally depends on the characteristics of warp and weft properties whereas weave type ad twist direction are merely responsible for enhancement of fabric strength in both direction, latterly the twist direction impact more on the tensile properties of the fabric.[7,8]

### II. Material and methods

#### Material:

The cotton warp of 60<sup>S</sup> Ne with three different counts were bought from Kolhapur (40<sup>S</sup> Ne, 50<sup>S</sup> Ne and 60<sup>S</sup> Ne) and 67, 84 and 100 PPI were selected for experimentation.[10] The details of the warp and weft testing's given below,

**Table 1 Yarn Strength and elongation properties details**

Warp/weft	Fiber	Linear density (Ne)	Tenacity (kgf/nm)	Elongation (%)
Warp	Cotton	60 <sup>S</sup>	15.30	4.25
Weft	Cotton	60 <sup>S</sup>	15.30	4.25
	Cotton	50 <sup>S</sup>	17.79	4.44
	Cotton	40 <sup>S</sup>	18.14	4.65

#### Methods:

The weaver's beam of 60<sup>S</sup> Ne were prepared in sizing and mounted on rapier loom (Model Optimax-4-R-540) with 170 end per inch and changes were done in weft as discussed earlier. There are three different weft selected for weft insertion on rapier loom - Model Optimax-4-R-540.

### III. Result and discussion

#### 3.1 Influence of weft count on Ends per Inch and Picks per Inch

Ends per inch and picks per inch were analyzed at different places in the fabric by using standard pick glass along and across the length of the fabric. The total investigation were done on loom and after loom [11]. The tested results shown below

**Table 2 Influence of weft count & PPI on Ends per Inch (EPI)**

Weft Count (Ne)	PPI – 100		PPI - 84		PPI – 67	
	EPI On Loom	EPI relaxed State	EPI On Loom	EPI relaxed State	EPI On Loom	EPI relaxed State
60	170	172	170	171	170	170
50	170	171	170	172	170	171
40	170	172	170	171	170	171
Influence of weft count on Picks per Inch (PPI)						
60	100	100	84	85	67	68
50	100	101	84	85	67	67
40	100	100	84	85	67	68

It is seen that the weft count influenced both on the EPI and PPI on machine and relaxed state. It was observed that for 60<sup>s</sup>, 50<sup>s</sup> and 40<sup>s</sup> weft count EPI were found to be

1. 100 PPI – 172 EPI at relax state
2. 84 PPI – 172 EPI relaxed state
3. 67 PPI – 171 PPI at relaxed state.

This result showed that the fabric contraction is more with 67 PPI.

#### 3.2 Influence of weft count on warp and weft cover factor

Cover factor defines that an area covered one set of threads.

**Table 3 Influence of weft count on fabric cover (before)**

Weft counts(Ne)	PPI – 100		PPI – 84		PPI – 67	
	X	Y	X	Y	X	Y
60	21.94	12.90	21.94	10.84	22.18	8.64
50	21.94	14.14	21.94	11.87	22.17	9.47
40	21.94	15.81	21.94	13.28	22.94	10.59
Influence of weft count on fabric cover (After)						
60	22.20	12.90	22.07	10.97	21.94	8.72
50	22.07	13.03	22.20	12.02	22.07	9.47
40	22.20	15.81	22.20	13.43	22.07	10.75

\* X- Warp cover

\* Y – Weft Cover

The aim of the project is to determine the impact of different weft count yarn and Pick density on fabric properties to measure the weaving performance. From the test result it was seen that as PPI increases cover factor also increases. It was seen from Table 4 and 5 weft cover factor. Average range of warp cover factor for satisfactory weaving performance lies within 22 or more whereas the weft cover factor would be around 8.64 to 15.81. The fabric cover factor over 24 was responsible for preparing of high density fabric which would prone more stoppage causes loss in efficiency & detroit's fabric quality & its properties [12].

#### 3.3 Influence of weft count on weaving performance (warp and weft breakages)

The weaving machine working efficiency is purely depends on the machine condition, the quality of material and twist level of the yarn used for weaving. Performance was entirely depends on the quality and twist level of used warp and weft. Similarly the rate of breakages can be observed in terms of CMPX and other breakages [13, 14]. It was seen that breaks for different weft count and densities, weft count (40<sup>s</sup> Ne, 50<sup>s</sup>Ne and 60<sup>s</sup> Ne) shows low breakages for 100, 84 and 67 PPI.

#### 3.4 Influence of weft count on fabric crimp

It is essential property of the fabric which govern the crimp of the fabric during fabric manufacturing, in which two sets of yarn interlaced to get fabric to impart certain crimp in the fabric. The fabrics were analyzed for calculating crimp and results are indicated below in table no 4.

**Table 4 Influence of weft count on fabric crimp**

Weft counts(Ne)	PPI – 100		PPI - 84		PPI – 67	
	Warp C	Weft C	Warp C	Weft C	Warp C	Weft C
60	9	8	9	7	8	6
50	12	10	11	9	8	8
40	16	12	13	10	11	9

\* C- Crimp

It is an important property of yarn that can be significantly influenced by yarn count and fabric density. The observations based on the table no 7 shows that if weft count increases the warp crimp increases vice versa. The reason for increasing in crimp was majorly concern with count of the yarn, as coarser it will be more rigid. Higher the crimp higher will be warp consumption. Warp consumption rate is directly proportional to warp tension. Unwinding rate of the warp sheet causes to apply the tension on the warp uniformly, if there any change in the tension help to reduce warp crimp resulted to increase weft crimp vice versa. It was found that there is a difference between on loom and after loom warp and weft crimp properties this may be due to there was no warp tension in relaxed state [15, 16].

### 3.5 Measurement of fabric tensile properties

It is an important parameter of the woven fabric that determines the durability of textile material. In this project work, prepared nine samples were tested for warp way strength and weft way strength by using Paramount *dig*i STRENGTH I Nx digital tensile strength tester available in the DEESAN -2 Unit, Textile Park Shirpur, the result are summarized below.

**Table 5 Influence of weft count on fabric strength**

Weft counts(Ne)	PPI – 100		PPI - 84		PPI – 67	
	A	B	A	B	A	B
60	798.87	569.85	802.09	434.49	680.21	317.29
50	772.03	607.57	794.15	487.92	676.13	383.56
40	670.44	1524.83	738.45	1381.89	721.89	1095.53

\* A – Warp count

\* B – Weft Count

It was deduced from the test results shown in the Table 5 that for increased PPI strength of the fabric increases considerably in weft direction for coarser weft count other fabric parameters such as warp count and EPI were kept constant vice versa. This may possible due to the fact that finer yarn have comparatively low strength than coarser yarn [17].

### 3.6 Measurement of fabric extension properties %

Based on the tensile strength the fabric extension result were obtained and shown below

**Table 6 Influence of weft count on fabric extension %**

Weft counts(Ne)	PPI – 100		PPI - 84		PPI – 67	
	A	B	A	B	A	B
60	32	13.4	27.4	14.3	38.6	10.2
50	25	16.7	25.7	15.3	35.6	13.2
40	20	18.4	22.8	18.2	30.5	13.4

\* A – Warp count

\* B – Weft Count

Fabric extension is a result of addition of yarn (extension + crimp = fabric). The result discussed in the table shows that the fabric extension was increases as increase in both weft count and pick density of the fabric [18]. The explanation behind this might be singular weft yarn augmentation separated from this the pleat is specifically identified with the expansion of the texture. This is the motivation behind why augmentation of texture is fundamentally more prominent than that of relating expansion of yarns [19, 20].

## IV. Conclusion

The picks per inch and weft count both considerably influences the cover factor, strength and crimp of the woven fabric and ultimately the weaving performance. These findings in the weaving help to enhance the loom performance by

optimizing the different weft count and pick densities. The data collected on real time basis in a textile industry helped to set a standard for different pick density. This may give idea about yarn consumption in fabric, fabric strength, fabric elongation, crimp and cover factor. From the research it was found that the average range of warp & weft cover would be in the range of 22 or more and 8.64 to 15.81, whereas for satisfactory working of weaving machine the total cover factor would be below 24 otherwise more stoppage causes loss in efficiency. From the continuous observation and data collected it was seen that the yarn consumption was increased as the yarn become coarser with increased PPI.

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