



Research Article

Comparison of contamination on yarns produced from local and us blend cotton types

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ABSTRACT

Contamination on cotton fibers is one of the most important problems that shows itself on yarn and fabric. Contamination usually consists of plant leaves, parts, etc. on the cotton and this situation occurs during the harvesting and transporting. Also contamination occurs by bale pieces such as burlap, nylon and polypropylene residues. Developed technologies are using for selection of the foreign material in blowroom and bobbin processes, but it is not possible to completely remove the foreign material from the yarn. In general, the amount of foreign material in the local cotton is more than the US cotton. In this study, yarn production is made in the same specifications with local and US cotton, then yarn foreign material cuttings on bobbin machine and yarn quality values are compared. According to the results, it is seen that yarns produced by US cotton have less contamination than the yarns produced by local cotton. With this situation it is determined that, despite less contamination, yarn technical values of US cotton is worse than local cotton.

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1. Introduction

Cotton is one of the most favorable and widely used fiber because of its many positive attributes and naturality. One of the most important problems that seen in yarns made from cotton fiber is amount of foreign material that yarns contain.

Foreign material or in other word is contamination, is an important problem that causes many yarn and fabric defects. This situation is one of the major problems of cotton yarn manufacturing. Foreign material causes yarn breaking and causes low level of dye penetration. Nowadays foreign materials on fiber and yarn are cleaned in the blowroom and bobbin machines in spinning mills, but it is not possible to clean completely foreign material from the yarn.

Contamination usually occurs during the harvesting, packaging and storing of cotton fiber. The parts of the cotton plant do not cause contamination. However foreign materials that causes contamination such as fabric pieces that are mixed into during hand picking of the cotton or another materials that involved during ginning. Besides; packing, pieces of baling like burlap, polypropylene and nylon are also causes impurity.

Gençer O. et al. researched that, despite the high volume of cotton production in Turkey, there are problems that affect cotton production negatively and these problems need to be solved. These problems are summarized as, problems related to politics; high production costs of cotton plant raising; problems in cotton varieties, seeds and production techniques; cotton harvesting, ginning and foreign material problems; issues in cotton standardization system; inadequate training on cotton production and processing technique; inadequacy of communication and cooperation between cotton-related sectors [1].

One of the biggest problems observed in cotton produced in Turkey is the amount of contamination. A research by Kaya H. et al. is indicated that spinning mills use local cotton have a number of problems in different percentages. 47% of them have contamination, 28% of them have unstandardization (inhomogeneous balls, unknown fiber properties, and etc), 23% of them have fiber quality properties (low tensile strength, coarse micronaire values, low maturity values, nep and high ratio of short fiber content) and 2% of them have of high cost disadvantage. In the same study, types of contamination were examined and indicated that 48% of them contains foreign material (jute,

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polypropylene, pieces of coloured clothing), 37% of them contains organic based foreign materials (plant leaves, particles, etc.) and 15% of them have metal pieces (wire, pieces of equipment) as an important contamination material [2].

A research of ITMF (International Textile Manufacturers Federation) indicated that the highest contamination is seen in regions of India, Nigeria, Zimbabwe, China and Turkey. The regions that produced the cleanest raw cotton are the USA (Texas, Arizona, Pima, Memphis and California), Syria, Benin, Brazil, Spain, Argentina, Greece and Australia [3].

Yarn producers prefer US cotton because of the fact that the harvest is made by machine in US and the low level of contamination is guaranteed by the producers. Yarns produced by US cotton contain less synthetic foreign material like nylon and polypropylene and coloured foreign fiber than local cotton produced in Turkey especially in South Eastern Anatolia Region. This study is made for comparison of contamination of yarns produced by local and US cotton.

2. Foreign Material

Foreign materials are visually checked and sorted by the worker, moreover they are sorted out by machines like Truetzschler SP-F, SP-PU and Uster Jossi Vision in the blowroom. Despite this, it can not be cleaned completely and foreign materials can reach to the yarn. Figure 1 shows samples of coloured foreign materials reaching from the blowroom cleaning line to the yarn.

Foreign materials can be classified as vegetable particles, baling materials and trash (Figure 2 and Figure 3).

Vegetable particles:

- Generally in short length range,
- In density spectrum from low to high,
- Can be cleaned after processes like bleaching, so it is not necessary to be cleaned in yarn process.

Foreign fibers and baling materials:

- Spread to the entire spectrum, regardless of length and density,
- Have to be cleaned as soon as when they exceed the limits of disturbing foreign material.

Trash:

- Generally long and rarely contains more faults,
- Must be removed at the relevant cleaning limits [4].

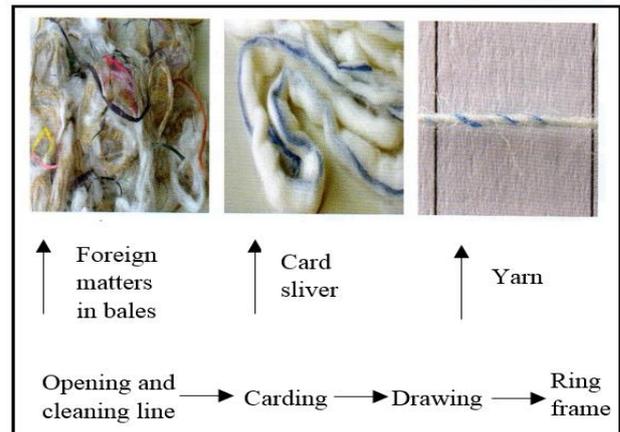


Figure 1. Foreign materials at different stages of the spinning process [5]

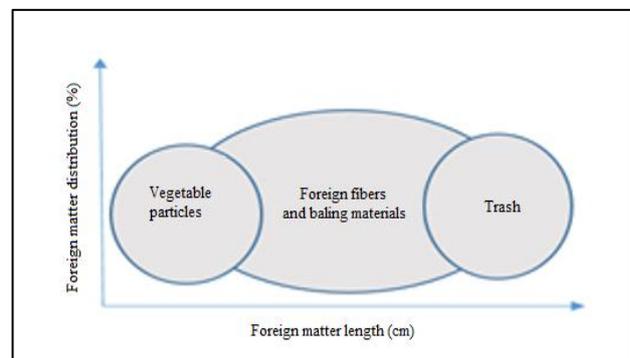


Figure 2. Distribution of foreign fibers on a cotton yarn [4]

Vegetable foreign materials can be removed from the fabric by the bleaching process. In Figure 4, various vegetable foreign material samples are seen on the raw fabric and after pre bleaching process.

Foreign materials can be coloured or synthetic origin (such as nylon, polypropylene). In the case of coloured foreign materials are not to be separated from the yarn, they can appear especially in bleached and light coloured fabrics. Synthetic foreign materials such as polypropylene have a colourless structure. Because of this situation, it is very difficult to remove synthetic foreign material from yarn. They do not absorb dyestuff during dyeing, so there will be uncoloured places on the fabric.

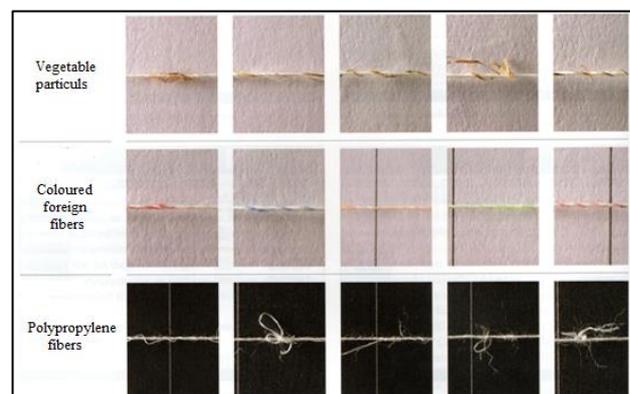


Figure 3. Foreign material types [5]

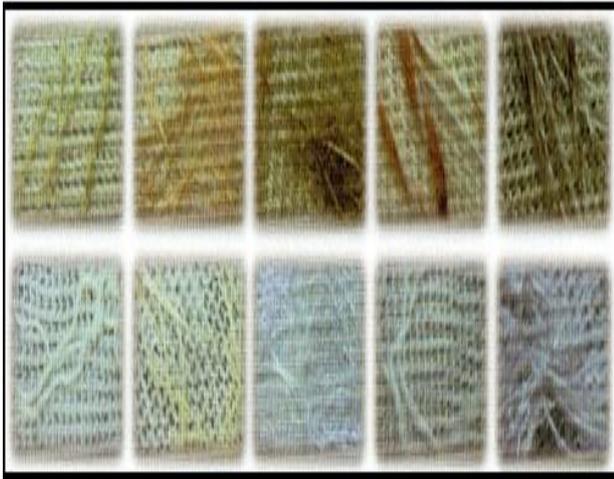


Figure 4. Foreign material images on raw fabric and bleached fabric [5]

On bobbin machine, foreign materials are classified as foreign dark matter, foreign light matter and polypropylene foreign matter. Foreign dark matters are selected from light coloured yarns; foreign light matters are selected from dark coloured yarns. Synthetic foreign materials like polypropylene are cleaned by a separate channel.

In Turkey, during the collection of cotton, many cloth pieces which cause foreign material can be mixed into the collected cotton. These coloured foreign materials are sliced in to very small pieces during the yarn production process, in the case of not being extracted in the blowroom. In bobbin machines, yarns are cleaned by yarn cleaning systems like Uster, Loepfe. When the amount of foreign material is too much and effective cleaning setting cannot be setted, the foreign material fault cannot be removed from the yarn. In Figure 5, non-removable coloured foreign materials are seen on the fabric. The same situation is observed on uncoloured synthetic foreign materials such as polypropylene and nylon. These synthetic foreign materials are sliced in to very small pieces up to the yarn, in the case of not being extracted in the blowroom. When the amount of synthetic foreign material is too much and effective cleaning setting cannot be setted, the synthetic foreign material fault cannot be removed from the yarn. In Figure 6, these non-removable synthetic uncoloured foreign materials are seen on the fabric.

Yarn producers in Turkey prefer US cotton especially for foreign material guaranteed orders, because of the low content of foreign material in US cotton.



Figure 5. A disturbing coloured foreign material sample on knitted fabric [5]

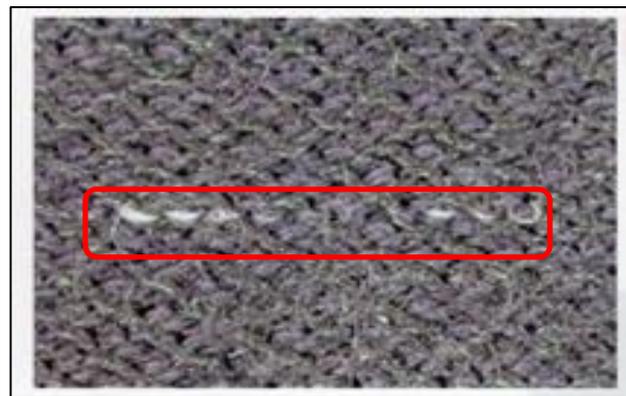


Figure 6. A disturbing polypropylene foreign material sample on knitted fabric [5]

3. Material Method

In this study, combed yarns were produced by using Diyarbakır local cotton and US cotton. The yarn samples were produced by ring spinning frame with the yarn number of Ne 40 and yarn twist multiplier (α_e) was 3,7. Yarns were bobbinned with same cutting settings in the Uster Quantum 3 cleaning system. For determining cotton properties, cotton samples were tested with Uster HVI and Uster Afis devices. For determining the yarn technical values, the yarn samples were tested with Uster Tester 4 device. The Uster Tensojet 4 device was used for determining yarn tensile and yarn elongation.

4. Results and Discussion

According to the results of Uster HVI (Table 1), it was observed that, spinning consistency index, fiber length, short fiber index, uniformity index and strength values of Diyarbakır local cottons are better than those of US cottons. However the values of trash count and trash area are worse than those of US cottons. The same situation can be seen in Table 2, which contains the results of Uster Afis device. Short fiber content of Diyarbakır local cottons is lower than that of US cottons. However the amount of dust and trash count of Diyarbakır local cottons is worse than those of US cottons.

In Figure 7, HVI colour grades for American upland cotton are seen. In this study, green marked area shows US cotton and red marked area shows Diyarbakır local cotton. According to results of Table 1 and Figure 7, colour grades of US cotton is better than Diyarbakır local cotton.

Table 1. Test results of Uster HVI

	Diyarbakır local cotton	ABD cotton
SCI	148	137
Micronaire	4.65	4.14
Length	30.1	29.4
SFI	5.1	7.9
UNF.	83.8	82.3
STR.	33.7	30.7
ELG.	6.2	6.9
C-Grade	31	11-21-31
Rd	76.8	79.0
b+	8.2	8.9
Trash Count	33	17
Trash Area	0.59	0.18

Table 2. Test results of Uster Afis

	Diyarbakır local cotton	ABD cotton
Nep cnt/gr	114	295
Nep [um]	785	678
UQL(w)[mm]	32.0	31.7
L (w)[um]	25.2	25.5
L (n)[mm]	22.2	23.1
SFC (w)	5.4	8.4
SFC (n)	17.2	26.8
Dust cnt/gr	1193	441
Trash Count	129	55

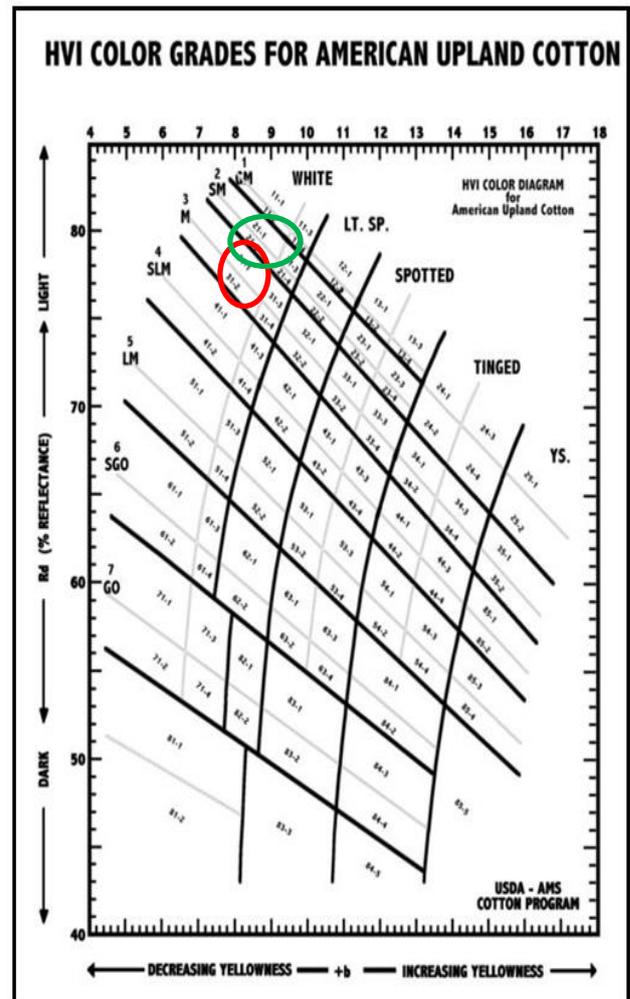


Figure 7. HVI Colour Grades for American Upland Cotton [6]

In this study, Ne 40 combed cotton yarn was produced with Diyarbakır local cotton and US cotton. Yarns were bobbinned with same cutting settings in the Uster Quantum 3 cleaning system and the results are compared.

Diyarbakır local cotton and US cotton compared by visually and it is clearly seen that US cotton is more clean than Diyarbakır local cotton. This situation is parallel to results of Uster HVI and Uster Afis devices. After cleaning of yarns on bobbin machine with Uster Quantum 3, the results of yarn cuttings on 100 km are shown in Table 3. In this study, it was aimed to compare foreign material of yarn samples, so in Table 3 only total yarn faults and foreign dark matter cuttings were given.

Table 3. Total yarn cuttings and foreign material cuttings on 100 km

YARN TYPE	NE 40 COMBED YARN	
BLEND TYPE	DIYARBAKIR LOCAL COTTON	US COTTON
Total Yarn Fault Cuttings	76	48
Foreign Dark Matter Cuttings	22	15

According to these results, it was observed that the yarns produced by US cotton blend have less yarn fault and foreign dark matter cuttings than those of Diyarbakır local cotton blend. When the foreign materials cleaned from the yarns were examined, it can be seen that the foreign materials separated from US cotton yarns are smaller in size than that of local cotton yarns.

After bobbin processes, the yarns are tested in Uster Tester 4 and Uster Tensojet 4 devices. Results of these tests are seen in Table 4.

According to the results of yarn quality tests, it is seen that the yarns produced by Diyarbakır local cotton have less yarn imperfection values (total number of thin places -50%, thick places +50% and neps +200%) than the yarns produced by US cotton. The tensile strength is evidently high with the yarns produced by Diyarbakır local cotton.

Table 4. Yarn quality tests

Ne 40	Diyarbakır local cotton	US cotton
Cv _m %	12.7	13.1
Thin places -40% / km	83	106
Thin places -50% / km	2	1
Thick places 35% / km	263	385
Thick places 50% / km	21	31
Nep 200% / km	36	48
Hairiness	3.4	3.7
Tensile strength cN/tex	20.2	17.8
Breaking elongation %	4.1	4.4

5. Conclusion

In bobbin process, low yarn cuttings are always expected for the performance of weaving and knitting processes. According to the yarn cutting results, the yarns produced by US cotton have less yarn faults and foreign matters than the yarns produced by Diyarbakır local cotton.

In addition, tensile strength is one of the important property of yarn. As clearly visible in the results, US cotton yarns have less tensile strength than local cotton yarns. With this situation, US cotton yarns have higher thick and nep places. If the current prices of US and local cotton are compared, it can be said that US cotton is more expensive than local cotton.

Despite the worse yarn technical values and the high price, the low amount of contamination and yarn cuttings in bobbin process are the reasons for preference of US cotton for foreign product guaranteed production.

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