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Date: 11 July 2019
Comparing Handspun to Commercial Cotton Yarn for Home Knitting Machine Use

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June 28, 2018
Abstract

This study compares four groups of cotton yarns used on a home knitting machine. Group I is two cotton warp yarns and two similar semi-worsted handspun yarns. Group II is two soft commercial cotton knitting machine slub yarns and two similar handspun semi-worsted cotton slub yarns. Group III is two handspun yarns each finished in a different way: one boiled for one hour with detergent and the other soaked for 10 minutes in warm water with detergent and fulled lightly. Group IV is two handspun cotton yarns: a 3-ply spun from commercial sliver and a 2-ply yarn spun from commercial punis. Two knitting machines were used: a Passap e-6000 and a Silver Reed LK-150. Samples were compared by counting the number of dropped stitches, numbers of broken threads, and ease of use. No significant differences were found. Questions such as comparative washability and fabric transparency are subjects for future studies.
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Introduction

I became interested in spinning cotton shortly after I moved to southern New Mexico. Hot weather begins early in the year here and ends late, making wool sweaters nearly impossible to wear beyond an eight to twelve-week period in the dead of winter. Thinking that cotton sweaters would be more likely to be worn during both spring and autumn, I began to wonder if the cotton yarn I’d been spinning could be used on the old knitting machine I’d been given. Trying it out for myself began to seem like the logical next step. Knowledgeable friends suggested that cotton would be too inelastic, even too stiff for use on a machine, while others said there would be no difference in a machine’s response to cotton and wool yarns. Many mechanical repairs and learning-curve challenges later, I was ready to begin a study comparing my handspun cotton yarns with readily available commercial cotton yarns in sizes suitable for a standard gauge knitting machine. This meant ordering yarns from weaving sources online, guessing at colors, and cadging from weaver friends’ stashes of almost forgotten yarn ends. As I intended to spin similar yarns for comparison, I limited my commercial yarn choices to a maximum of four plies, two contrasting colors, and a count range between 4 and 9.

Review of Literature

Development of Knitting Machines

The origins of spinning and knitting are lost to history but knitting machines have been mentioned in literature in their earliest forms. According to Delp Stockings and Gloves (n.d.), elaborate knitted stockings for men became fashionable during the 1500’s (“Sock History Bits” section). Van Der Klift-Tellegan (1985, p. 11) mentions a cotton
It wasn’t until Eli Whitney’s invention of the cotton gin in 1793 (Yafa, 2005, pp. 1-4; 87) that cotton became the easily available, omnipresent fiber that it is today. Richard Arkwright is credited with “harnessing the power of a stream in Lancashire to drive the intricate mechanical spinning machines” to begin the Industrial Revolution (Yafa, 2005, p. 45). Yafa describes in detail the events leading up to Arkwright’s innovative spinning factory, providing the story that connects Hargreaves’ spinning jenny, Paul’s carding machine, Wyatt’s engineering skills, Kay’s flying shuttle, and John Kay’s (no relation to the previous John Kay) drawing and spinning mechanism (Yafa, 2005, pp. 39-51). Early attempts to copy England’s industrial machinery were still being foiled in the 1760s. American factories were still using hand preparation methods at that time. Through a series of industrial piracy events (Yafa, 2005, p.79; 108-111) mechanical looms arrived on the East Coast. It was Whitney’s invention, however, that allowed Upland cotton to become the dominant variety of cotton in the United States (Yafa, 2005, p.16; 87).

Clothing manufacture in the U.S. was primarily a business of the South and a few northeastern states, but it was gradually brought to the southwest, specifically Texas, a state with strong southern roots. The number of clothing manufacturers waned in Texas during the Civil War of 1861-65 in the United States and by the 1870s had reached 33 (DeMoss, n.d., “Clothing Manufacture” section). These many small factories have gradually become many more and larger manufacturers (Harris, n.d., “Textile Industry”
section). While clothing manufacture eventually reached West Texas (Harris. n.d., “Textile Industry” section). it never reached New Mexico as a commercially viable business (The Collector’s Guide, n.d.). Even today it is a relatively modest industry in New Mexico with only a few businesses devoted to textile manufacture (New Mexico MEP, n.d.).

The need for stockings, hats, and gloves in quantity was the root cause of the development of knitting machines (Van Der Klift-Tellegan, 1985, p. 1; Nani, n.d. “Stocking Loom” section). Isaac Lamb, an American, developed a double bed knitting machine that produced a true ribbed fabric in the early 1860s. This machine was taken to England within a few years by James Foster. Eduard Dubied took it to France and Switzerland about the same time and developed the Passap line of machines. James Foster developed both factory and domestic machines for England, continuing to improve the machine until his early death. The sporting craze for games like golf, crochet, and bicycling, led to knitted outer clothing becoming popular fashion items (Kinder, 1992, p.4). Fashion for knitted items suitable for wear outdoors for both work and play may have started in the 1880s but it continues to this day. The knitting machines of the 1800s developed and improved on an industrial level until in the 1960s and 1970s effective home knitting machines were introduced by various manufacturers (Miodownik, 2015). Miodownik reported on his satisfactory interaction with the manufacturers of a 3D design-capable knitting machine, available in 2015 as open source technology for individual users (2015).
Development of cotton fiber

Yafa (2005, p. 12) reports archeological evidence of domestication of *Gossypium hirsutum*, a 1-inch long natural hybrid also known as Upland cotton, in Mexico at about 3500 BC. *G. barbadense*, a 2-inch long natural hybrid found in early Chile and Peru, was originally yellow, one of five shades of brown, russet or lilac. After the invention of the cotton gin, white Upland cotton became the variety of choice although other varieties had a brief period of local prominence. Upland proved to be the easiest to grow, giving the highest yields while standing up to mechanized manufacturing methods (Yafa, 2005, p. 16-17).

Farmers and gin owners were bragging about an early cotton crop in Southern New Mexico as early as 1905 when a single bale weighed 548 pounds and the gin itself had a capacity of 12 bales in a single day (The Beginnings of Cotton Raising in New Mexico, February 1905, p. 8). In 1929 New Mexico State University began its breeding program for a variety of Upland cotton that was better suited to southwestern growing conditions. This breeding program continues to the present time and has now produced over 30 varieties of Acala 1517 cotton (Zhang, n.d., introduction). According to Woodward (Wojcik, 2005, Tape One-Side B), a rancher and farmer since her childhood in 1925, Upland cotton was the main crop grown in southern New Mexico, although some farmers occasionally tried Pima (an early variety of Acala). She felt the new variety, then known as Supima, was a great improvement, easier to grow, requiring less chemical additions, and it was more productive, that is, more profitable. According to the New Mexico Annual Bulletin, farmers in the state are now producing 14,400 bales of Pima cotton annually but are still producing 88,000 bales of Upland cotton (2016, p. 50).
Spinning

All spinning experts recommend spinning cotton with some sort of woolen preparation and an American style long-draw or point-of-contact method (Davenport, 1953, p. 100; Linder, 2013, p. 36; Ross, 1983, p. 90). All suggest no tension or very light tension. Cotton slivers spun long draw on a wheel are mentioned but considered to result in a lesser quality yarn that is textured.

Cartwright-Jones discusses the challenges of using handspun yarn on the knitting machine. She recommends using wool, especially a woolen preparation (1990. p. 187-188). Bohn (unpublished In-Depth Study) reported that handspun Romney yarns could be successfully used on the knitting machine.

Methods and Materials

Methods

The yarns were divided into four groups to allow different aspects of using handspun cotton yarn on a home knitting machine to be examined. Each group was designed around one specific question. Commercial yarns were selected for Groups I and II and the handspun yarns used in these two groups were designed to mimic qualities of those commercial yarns. Groups III and IV used handspun yarns exclusively.

Groups I and II were knit on the Passap, using weights. Two colors for each group were prepared allowing three samples to be knitted, 1) stockinette, 2) tuck stitch and 3) fair isle. These three stitch types were chosen to challenge the yarn in both easy and more difficult situations. Because two colors were needed for the fair isle, two colors of one
yarn were chosen for Group I commercial yarns and two colors of handspun were prepared. Group II had two distinct commercial yarns and two colors of handspun.

Groups III and IV were knit on the LK-150, using weights. Each group used two different natural colors of yarn to allow easy comparison. The number of stitches in a row and the number of rows knitted were reduced as needed to make an unwashed sample approximately 4x4 inches square. This varied with each yarn knitted.

Amos gives clear instructions on making a puni. He recommends layering two thin cotton-card-sized batts and rolling them around a clothes-hanger wire (2001, p. 398). This is considered a woolen preparation as the fibers are short and carded into a tangled preparation with no order to the fibers themselves. Davenport’s version of a woolen preparation involves bowing or beating the de-seeded mass of cotton fiber with a flexible twig to produce a fluffy mass which is used to spin without further changes (1953, p. 100). These experts recommend using the point of contact method, sometimes called American long draw. Using this method, the spinner twists a tiny amount of fiber, pulls out a thread, adds more twist, and pulls more thread. The twisted fibers are wrapped around a spindle or bobbin as needed.

Davenport briefly explains the process of spinning a worsted-type yarn when using a cotton sliver prepared for machine spinning (1953, p. 101) and a short forward draw method of spinning. The Linders mention cotton slivers as a preparation in which the fibers are arranged longitudinally (2013, p.17). They describe a short forward draw worsted style for spinning which results in a textured yarn and go on to recommend a long draw style for a smooth strong yarn (2013, p. 34-36).
If the yarn is spun from a worsted preparation such as sliver, but spun woolen in a long draw or point of contact method, it is referred to as semi-worsted in this paper. If the yarn is prepared from a woolen preparation such as a puni or a fluffy mass and spun worsted using a short forward draw method, it was called semi-woolen in this paper. All the yarns in this study that were prepared from punis were spun using a long draw or point of contact method and were called woolen spun yarns.

Davenport describes how slub and tuft yarns are made (1953, p. 111-115). She describes a slub yarn as spinning as usual, then using a finger and thumb, pulling out a fat lump of fiber, followed by spinning as usual. She describes making a tuft yarn when plying by placing a tuft of fiber between two plies and twisting it into the final yarn. Her methods were used to prepare Yarn #6 as a slub yarn and Yarn #7 as a tuft yarn.

Zawistoski explains how to copy a commercial yarn (2017, p. 22-28). She describes an effective way to open a commercial yarn to capture the twist of the original singles. See Appendix E for a sample of how her techniques were used to measure the commercial yarns.

Gaustad explains that different colors could be developed in naturally colored cottons by choosing among a variety of alkaline solutions to soak the cotton before setting the twist by boiling (2018, p. 64-67). Laundry detergent was found to leave the natural green cotton both darker and a brighter green, so that was used on Yarns #3, #7, and #9. Yarn #10, a natural brown fiber, also received a laundry detergent bath but in this case the color change was not significantly darker or brighter than expected.

Davenport defines the count of cotton yarns as 840 yards per hank with the numbers of plies following the count, vis 13s/4 (1953, p. 124). As the placement of the
number of plies can be found in written form both before and after the count, her recommendations were followed here.

All yarns were spun using the long draw method. All yarn singles were spun Z and plied S. All the yarns were spun semi-worsted from Easy-to-Spin sliver except those in Group III, and IV, which were spun true woolen using punis and a point of contact long draw. Most yarns were spun on the charkha and plied on the Schacht, except for yarns #8, #9 and #10, which used the Schacht throughout. After their finishing treatment, all yarns were draped over a rod and allowed to dry without weights. All knitted samples were originally roughly 4 inches by 4 inches and were cut down, stitched along the edges, then glued in place for display (see Appendices A-D). All the samples shrank during the finishing process. All handspun yarns were waxed before using as directed by the manufacturers of the knitting machines. This procedure is designed to reduce the natural fuzz and loose fibers that might jam the mechanisms of the machines and cause errors, especially in electronic models. Commercial yarns were sized at the factory.

The question and yarn for each group are as follows:

Group I: How does a handspun warp yarn compare with a commercial warp yarn when used on a knitting machine? Yarn 1 in two colors and Yarns 3 and 4, three high twist, 4-ply smooth yarns were prepared. See Appendix A for the actual samples.

Group II: How does a handspun slub yarn compare with a commercial slub yarn when used on a knitting machine? Yarns 4 through 7, all moderate twist yarns, were prepared. Yarns 5 and 6 were slub or spiral 3-ply yarns; Yarns 4 and 7 were 2-ply tuft yarns. See Appendix B for the actual samples.
Group III: *Does the finishing technique make a difference? Contrast two handspun yarns, one boiled with detergent for one hour in the traditional manner, one soaked for ten minutes in warm water with detergent.* Yarns 8 and 9, two 3-ply yarns were prepared. The green yarn was spun woolen using hand-made punis and finished by simmering for one hour with a few drops of dish detergent and 1/2 teaspoon of washing soda. These punis were prepared from Easy-to-Spin sliver, hand-carded, then rolled on a 1/8th inch dowel. The fibers from this sliver were relatively long, reaching an inch and a half, making them difficult to spin as a puni. The white yarn was spun with the long-draw method from Easy-to-Spin sliver and was finished by soaking in warm water with 1/2 teaspoon of liquid laundry detergent for 10 minutes. See Appendix C for the actual samples.

Group IV: *Would a 2-ply woolen-spun yarn survive the rigors of a knitting machine as well as a 3-ply semi-worsted-spun yarn?* Yarns 10 and 11 were prepared. The white woolen-spun yarn was spun from punis that were commercially prepared in India. The cotton fibers were very short, typically 1/2 inch, but were contaminated with seeds and bits of husk. They were easy to spin but gave a highly textured single. A commercially prepared natural brown sliver was used to spin a semi-worsted yarn. See Appendix D for the actual samples.

**Measures**

Three measures were found to be useful for answering the questions: counting the number of dropped stitches; counting the numbers of broken threads; and ease of use. Ease of use was measured by the difficulty of passing the yarn carriage over the needle bed and
labelled as 1- easy, 2- difficult, and 3-very difficult. While this is still a subjective measure it gave an indication of the effort needed to use the yarn on the machines.

Materials

**Cotton yarns.** Eight cotton yarns were spun for use in this study, and four commercial yarns were obtained. All yarns were measured for the number of plies, the count (for example, 7s) and the number of wraps per inch (wpi), which are noted below. Yarn samples are provided in a plastic bag located after the Appendices.

**Group I Yarns, by number**
1. Yellow or turquoise commercial cotton warp, 4-ply, 7s/4, 20 wpi
2. White handspun yarn, 4-ply, 13s/4, 23 wpi
3. Green handspun yarn, 4-ply, 11s/4, 20 wpi

**Group II Yarns, by number**
4. Red commercial tuft yarn, 2-ply, 6s/2, 22 wpi
5. Pink commercial spiral/slub yarn, 3-ply, 9s/3, 20 wpi
6. White handspun spiral/slub yarn, 3-ply, 8s/3, 15 wpi
7. Green handspun large tuft yarn, 2-ply, 10s/2, 22 wpi

**Group III Yarns, by number**
8. White semi-worsted handspun yarn, 3-ply, 7s/3, 15 wpi
9. Green woolen handspun yarn, 3-ply, 7s/3, 14 wpi

**Group IV Yarns, by number**
10. Brown semi-worsted handspun yarn, 3-ply, 6s/3, 12 wpi
11. White woolen handspun yarn, 2-ply, 4s/2, 15 wpi
Tools. For spinning, I used two wheels. The first is a simple box charkha imported from India with a ratio of approximately 40:1. The second is a Schacht Matchless set on a ratio of about 20:1 with a high-speed bobbin.

The fiber came from three sources: Easy-to-Spin sliver in white and green purchased at a spinning gathering; natural brown sliver from the Woolery; and imported white punis from an online source in India. The Easy-to-Spin and the brown sliver were well scoured, leaving little trash or discoloration in the wash water. The commercial punis had many seeds and bits of vegetable matter, which left a textured yarn that was not particularly noticeable as a woolen 2-ply but needed an extra rinse. All fibers were finished with a vigorous warm water bath with a few drops of laundry detergent except for Yarn #9, which was boiled with detergent and washing soda. Both processes full the yarn slightly.

Two knitting machines were used. The Passap e-6000 (Passap) is a standard gauge, suitable for lace-weight, baby-weight and fingering yarns. The Silver Reed LK 150 (LK-150) is a mid-gauge and suitable for sport or DK yarns.

The samples were knitted on the machines over a two-week period. They were knit on a single bed using a typical two-row cast on in waste yarn. Twenty rows of waste yarn were knitted, then the sample, then an additional 20 rows of waste yarn before removing the sample from the machine. All samples were allowed to rest at least 24 hours before blocking.

Results

The sample yarns responded to knitting on the machine in different ways, but all
made interesting fabrics suitable for use in a variety of ways. See Figure 1 for details related to each individual yarn. The samples are displayed in Appendices A-D.

**Figure 1. Comparison of Results for All Yarns After Knitting**

<table>
<thead>
<tr>
<th>Yarn #</th>
<th>Stockinette</th>
<th>Tuck Stitch</th>
<th>Fair Isle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 missed stitches</td>
<td>3 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>2 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 2</td>
<td>Ease of use – 3</td>
<td>Ease of use – 2</td>
</tr>
<tr>
<td>Yarn #1</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #2</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #3</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #4</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #5</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #6</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #7</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #8</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #9</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #10</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
<tr>
<td>Yarn #11</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
<td>0 missed stitches</td>
</tr>
<tr>
<td></td>
<td>0 broken threads</td>
<td>0 broken threads</td>
<td>0 broken threads</td>
</tr>
<tr>
<td></td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
<td>Ease of use – 1</td>
</tr>
</tbody>
</table>

Note: Red ink was used to highlight any result above 0 or minimal.
Conclusions

Looking at the numbers, the only yarn that was difficult to knit using the knitting machine was the commercial cotton warp yarn, #1. Its stiffness can be easily seen by examining the tuck stitch sample in Appendix 1, which, if knitted into an appropriate sized piece, could be used as a free-standing sculpture. Two threads were broken due to its inflexibility at turning the row. This small study is unable to draw significant conclusions but can provide indications to the spinner/knitter of the strength and beauty of their own handspun yarn in a machine-knitted garment. Questions about shrinkage and durability of the finished cloth remain. Other questions for future study might include looking at whether there is a difference in beauty or durability when all yarns are prepared the same but using different types of cotton. Would a cotton-synthetic blend of fibers such as used in many commercial yarns perform better on home knitting machines?

Knitting machine peculiarities were not examined in this paper but several questions arise. Did the knitting machines themselves demand a woolen or worsted preparation? Does one brand of knitting machine handle cotton better than another? Is cotton yarn a better choice for a finished fabric if one special technique is chosen rather than another?
References


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Appendix A
Group I

Yarn 2
Tuck

Yarn 1
Tuck

Yarns 2 and 3
Fairisle

Yarns 1
Fairisle
Yarn 6
Tuck

Yarn 5
Tuck

Yarns 6 and 7
Fairisle

Yarns 4 and 5
Fairisle
Sample #2
Tpi, singles
Commercial yarn #1

Sample #4 were soaked in warm water to restore the original twist.

Sample #2
Tpi final yarn
Commercial yarn #1

Soaking the sample in warm water revealed a moderate amount of under-twist.
Appendix E
Commercial Yarn Deconstruction

Sample #3
ply size commercial yarn #5

Sample #3
TPI singles commercial yarn #5

#2 & 3 were soaked in warm water to restore the original twist.

Sample #3
TPI final yarn commercial yarn #5

Soaking in warm water revealed a small amount of overt twist.
Sample #4
Ply size commercial yarn #4

Sample #4
TPI singles
commercial yarn #4

#2 was soaked in warm water. The original twist was restored.

Sample #4
TPI, final yarn
commercial yarn #4

Soaking in warm water revealed a tiny amount of over-twist.
Sharon Ewing, Level 6:

100% Cotton

COMBED CARDED
ROLAGS / TOP/Roving Pom" WOOLEN Worsted
Spun 2%, plied 2/5
Finish: Warm Sock

2 plies TPI: 5 1/2
WPI: 15 TA: 35°
2.3 gms 10 Yds
Count 4/3
End Use: Yarn #11
Group IV Samples

Group II yarns

Europlas

ROLAGS (TOP/Roving)
WOOLEN Worsted
Spun 2/5, plied 2/5
Finish: Warm Water Sock

2 plies TPI: 12
WPI: 22 TA: 35°
1.1 gms 10 Yds
Count 10s
End Use: Yarn #17
Group II Samples
Woolen/Worsted

Spun 2/5, plied 2/5
Finish: warm water soak

4 plies
WPI: 20
TA: 39°
1.9 gms
10 yds
Count 1/5
End Use: Yarn #8

Group I Sample