SURI FABRIC PROJECT 2013

GASTON COLLEGE FABRIC SAMPLER

By: Beth Brown: Odelia Farms, Odelia – Signature Alpaca Wear. Beth has been a knitter for as long as she can remember, and a spinner for over 25 years., giving her a good eye for balanced yarns and a feel for a soft hand.

Donna Rudd: Donna is a Certified International Wool Judge, Mohair Judge and Spin off judge, Suri llama classifier and a Certified Camelid Fiber Sorter and Grader. She has studied suri fiber processing in Peru and attended the Gaston College Community Mill Course
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Purpose of the project

The original purpose of the woven fabric project was to see if we could create a fine 100% suri alpaca sampler in a variety of patterns to evaluate the performance of each pattern. Our goal was to create a fine suri cloth and to test it for its durability, hand, appearance and luster. Also of interest, was to evaluate the performance of the yarn in both the spinning and weaving processes without being blended with other natural fibers.

The Process

The committee was able to purchase 20 lbs of grade 2 white suri alpaca from the North American Suri Company who delivered a fine grade of suri alpaca, with less than 1% vegetation or impurities. The fiber was then sent to Rachel-Alpaca Processing Mill to be scoured and carded into roving. Out of the 20 lbs approximately, 17.5 lbs were left after processing. The roving was then sent to Lochs Fiber Mill in Vermont to comb and spin into a 2 ply lace weight yarn (worsted spun at 36 twist per inch/5,000 yds/pp). We were able to have 5.2 lbs. of yarn made with the other 9.3 lbs left as combed top. This project provided a unique opportunity to spin North American suri fiber processed to the combed top stage and then spun using a worsted technique. In the US, suri fiber is rarely combed and mills typically spin suri using a semi-worsted technique. Suri is enhanced by the worsted spinning process which reflects the inherent luster in the fiber, such as one sees in a flat knit. The woven patterns benefit from a fine, consistently balanced, lustrous yarn. We were very excited to have this opportunity to use such fine fiber, have excellent fiber preparation, and benefit from Gaston College’s new sampling equipment.

Yarn threads

Yarn spool

Woven Sampler

The yarn was then sent to the Gaston College Textile Center to weave it into a narrow sampler that would change patterns approximately 6-8 times. Mr. John Fowler of the Textile Center was asked if he could weave the yarn into a fine fabric sampler that would give us a very good idea of how well the yarn performed. The turn-around time was less than a month and we were thrilled that it would be in time to display at the 2013 Suri Symposium in Estes Park, CO. The following is an evaluation of the samples, the weave patterns used, and their performance. We appreciate all the time and effort provided by our committee member, Donna Rudd, in her evaluation of the following samples.
WOVEN SURI FABRIC EVALUATION:

The following is our evaluation of this suri sampler that was woven by Gaston College for the Suri Network Product Development Committee from yarn spun of grade #2 suri alpaca. This fiber had been graded (NASCO), washed/carded (Rachel Alpaca Processing Mill) and combed (Lochs Maple Mill) before being spun into 2 ply worsted yarn at 5,000 yards per pound.

The sampler varied in width from approximately 8 inches to 12.5 inches in width to 79.5 inches long before it was washed in mild soap and pressed. The width varied because of the various edges being either unfinished or leno machine finished. The overall width did not change in washing. The length was 79.5 inches before washing and 78.5 inches after washing which resulted in only a very small amount of shrinkage, 1-2%.

During individual evaluations we mention that more twist in the warp yarn would have resulted in a superior fabric. Overall, we felt that because of the twist being under-spun in many places, the fabric did not come up to the standard we would have preferred. A warp yarn with substantial twist will resist pilling as well as stand up to the rigors of the weaving and finishing process. The weft yarns, which are not under tension, aren’t subject to abrasion in the reed or as much tension in the weaving process, can be lightly twisted either single or plied. Tightly twisted yarns do not necessarily produce dense, stiff fabrics. It is the fiber that you begin with and the grist to which you spin it that really determines the drape, hand and feel of the fabric. Fine fibers spun with a firm twist can retain their soft hand when woven into soft fabrics.

The patterns on this sampler vary in threads per inch and tension; this gives us valuable information regarding the way suri yarn behaves when woven. Notice how beautifully the tightly woven fabric is so durable yet reflects light and has interesting textural features. However, the patterns near the end, or those patterns woven with the 36 ppi really show suri fabric outstanding traits of luster and drape to their utmost.
SAMPLER #1 3X 1 X 8 X3 Basket Weave 32 ppi

Size: After mild washing; 11 1/5 inches wide X 7 7/8 inches long

Edges: Are finished on the right and left by leno stitching

Warp: There is protruding raw yarns at top and bottom bound by sample #2. A few warp threads were under-spun and showed up clearly on the unwashed sample and more so on the finished sample.

Weft: The pattern is very appealing, the floating weft threads add luster to the fabric.

Visual Impression: This pattern shows off suri luster and hides much of the spinning flaws of the warp threads.

Hand: After washing the hand is supple, cool, and slick. It exhibits very good texture and drape.

Bloom and Twist in the yarns: The few under-spun warp yarns held during weaving, probably because of their length, there are some darker (most likely guard hairs) within the warp yarns and weft yarns, more so in the weft yarns in specific places that will be mentioned as we go along.

Weaving Balance and Patter: This pattern does not skew. It appears to be an excellent choice for 100% suri yarn.

Recommendations & Notes: The first 2 inches of the pattern is woven tightly and compact, the result of this is a fabric where texture and durability are important but drape would be compromised. By having the two samples side by side we can compare the tension of the two weaves and study how changing the tpi allows the fabric to become softer, more flexible and balanced.
SAMPLER #2  Plain Weave  32 ppi

**Size:**  After mild washing 11 ¼ wide x 11 7/8 long

**Edges:**  Leno finished on both Left and Right edges

**Warp:**  Top bound by #1 and Bottom bound by #3, Warp thread near middle right under-spun

**Weft:**  Leno finish on both sides.  There are warp and small weft flaws visible in this woven sampler.

**Visual Impression:**  This plain pattern does not exhibit any natural suri luster and gives the appearance similar to a cotton or fine linen.  The yarn bloomed very slightly from the gentle wash but the result was still a uneven finish.  The weave does show variation in the spinning twist and grist and also the occasional colored fibers.

**Hand:**  This has a rather stiff linen-type hand, I suspect that it would be very durable and long-lasting.

**Bloom and Twist of the yarns:**  Most but not all of the warp threads in this piece were spun evenly as were the weft threads so this made the sampler evenly woven.  We believe the yarns did not fully bloom because it may have been a rather tight weave to begin with which is ok if you want a really durable fabric.  This plain weave may have benefited from slightly more washing than the other samples to allow the fibers to relax and open so that more spinning oils could be removed from the twist.

**Weaving Balance & Pattern:**  This weave really demonstrates that fine suri yarns can be woven into fabric that is sensible and durable for many projects such as upholstery fabrics and outer wear garments.  Notice how this even weave has its own character and texture.

**Recommendations and Notes:**  If we were to have this woven again we would like to see if a looser woven fabric would react differently, how much those fibers would have bloomed to fill the spaces without becoming too tight of fabric, possibly a 30 ppi.
SAMPLER # 3  8 Harness Fancy Basket Weave  32ppi

Size: After mild washing; 11 ¾ wide x 11 ¾ inches long

Edges: Sewn Leno finish on both sides

Warp: Bound by #2 on top and #4 at bottom. Some warp threads were open and under twisted in left hand side. Brown and dark guard hairs evident in some warp yarns.

Weft: Sewn leno finish on each side. One weft thread cut at back of this sample, reason unknown.

Visual Impression: This pattern shows flaws in the warp threads (which are numerous here) but the pattern exhibits both weft and warp luster, great texture. The fabric is not as nimble nor exhibits as much drape as some of the patterns shown later.

Hand: This has a tight firmer feel than some of the patterns seen later, yet it still has a cool smooth feel to the fiber and exhibits some heavier drape.

Bloom and Twist in the yarns: This yarn did not seem to bloom as much as some of the later samples, it maybe because the pattern was tighter or the samples at this end were on the inside of the fold during the wash. Either way, we would not want to see more bloom in the yarn or it would make this sample thicker and result in less drape. This pattern did obscure some of the under-spun warp yarn issues.

Recommendations and Notes: If this pattern was woven in a looser weave the yarns could bloom more making a softer fabric with better draping characteristics.

Top of weave    Back of Weave
**SAMPLER #4**

**5 X 3 Twill**

**36 ppi**

**Size:** After mild washing; 11 ¾ wide x 11 inches long

**Edges:** Right side leno finished, left side loose weft threads

**Warp:** Bound by #3 at top and #5 at bottom. There are under-spun warp threads on right side and a few black fibers found in them.

**Weft:** Good even yarns and weave.

**Visual Impression:** The twill floats show luster well but not as striking as samples 5,6,7. Our thoughts are that this is rather a ‘blah’ pattern and does not do suri yarns justice or show off the luster fully.

**Hand:** This sample has excellent smooth hand and exhibits great drape.

**Bloom and Twist of yarn:** The tension in the warp and weft is perfect and matches the twist of the yarn perfectly, but one of the more boring patterns.

**Recommendation & Notes:** Very good balance of yarn and weaving, excellent bloom of the yarn and it does a good job to hide any inconsistencies of the yarn grist where the plain weave could not do that. It could not however hide the under spun warp thread.
SAMPLER # 5  8 Harness Indian Running  36 ppi

Size:  12 ¾ inches wide x 10 ¾ inches long  (top half)
      13 ¾ inches wide (bottom half of sample)

Edges:  Are finished on right hand side with leno finishing and top half of left side with leno, bottom half of left side
       is raw threads

Warp:  top is attached to #4 and bottom is attached to #6. There are no obvious under-spun warp threads visible.
       Warp threads float over 5 weft threads giving allowing the suri yarn to display luster very well.

Weft:  Leno finish on right side and top half of left side

Visual Impression:  This is an excellent choice of patterns to show off suri luster and it provides great textural ef-
      fects to the fabric. The long warp floats and short weft floats each add a different element to the structure. This
      sample is an excellent example of how suri fabric can be utilized as it displays suri luster very well while providing
      an interesting texture in the pattern.

Hand:  This is a thicker, heavier fabric but still has a silk textured feel with a drapy hand.

Bloom and Twist in the yarns:  The yarns all appear to be balanced with no apparent over or under- twist in the
      yarns. They bloomed well when washed and are not crowded in the fabric. I feel this pattern is very well balanced
      in the spinning and weaving choices.

Recommendations and Notes:  Even though this pattern appears to be ideal in every aspect, it is suggested that the
      warp yarns could have been spun with more tpi to ensure that they were strong for the warping process.
Size: After mild washing: 10½ long x 14 inches wide

Edges: Right side finished with Leno stitch, left side cut open weft threads

Weft: Some weft threads throughout samples exhibit fine colored fibers, possibly fine guard hairs.

Warp: Few under-twisted and unevenly spun warp threads show in this pattern, though they did not break, but held together because of their length and strength.

Visual Impression: This pattern is an excellent choice to display suri luster and exhibit texture. However, there are numerous threads that appear to be unevenly spun and underspun in the warp that could easily compromise the integrity of the project. There are areas of dark threads appearing in the weft and warp threads from time to time, these threads can cause the eye to think there are weaving flaws in the pattern.

Hand: This pattern has excellent hand, smooth, yet textured with excellent drape without being too compact or stiff.

Bloom and Twist in the yarns: Again notice the fact that some of the warp threads are underspun in areas and that there appears to be larger slubs areas that are just not spun at all. These areas in the yarn should not be part of a warp as generally they pull apart from the tension during weaving. It is an indication that this suri yarn should have had a bit more twist in the warp threads. Otherwise the bloom of the yarn and the twist appears to be very good without too much bulk or thickness happening as a result of washing.

Weaving Balance & Pattern: This 8 Harness Crepe pattern exhibits the suri fiber’s characteristics of luster, smoothness and softness to its fullest. It has perfect balance and harmony.

Recommendations and Notes: This pattern is another indication that the warp threads were not spun with enough twist to be strong during the weaving process, however it also demonstrates that the longer suri fibers did indeed hold together when needed. This is one of the best examples of what 100% suri yarn can do to best demonstrate all of the attributes nature has given it.
SAMPLER #7  Weft Herringbone  36 ppi

Size: After mild washing 13 ¾ wide x 12 ½ long

Edges: Right side finished with Leno stitch and left side open weft threads unevenly cut

Warp: Bottom threads open and unbound, top bound by #6. There are some thicker under-spun warp threads in this pattern but they are obscured by the floating pattern and only visible on the back side.

Weft: 2 inches from top of this pattern is 1/8 – ¼ variation of pattern which appears to be a flaw in weaving pattern, but indeed is just some pics of the weft yarns with darker colored fibers in it.

Visual Impression: This is an excellent pattern choice for these suri yarns as the weaving floats display the suri luster to the utmost. The floating weft yarns reflect light extremely well in this pattern and I think it is one of the best examples of suri weaving in this project. Notice how ‘clean’ the suri fibers are and we think this adds to the fact that it reflects light so well, as does the fact that the yarns are not over-twisted.

Hand: This piece has excellent hand, it is light, yet exhibits drape, it has texture but is not thick and heavy. We love this sample because it is so supple and malleable.

Bloom and Twist in the Yarn: All the yarns bloomed evenly without becoming too bulky. The warp yarn that was under-twisted did not affect the overall structure or appearance of this pattern. There are some colored fibers which catch my eye from time to time, this is a distraction and a fault but not the weavers fault.

Weaving Balance and pattern: This Herringbone Weft pattern is an excellent choice for suri yarns because it displays suri luster to its utmost. It also does an excellent job of hiding the warp yarn defects. I think the pattern is perfectly balanced without being too tight or too loose.

Recommendations and Notes: This sample has texture and depth yet drape and strength, if a person were wishing for more durability, I would suggest more twists in the warp yarn and possibly a few more threads per inch in the weave.
SUMMARY:

The suri fabric project of the Suri Network Product Development Committee provided us with 7 different patterns spun woven from 20 lbs of 100% suri, grade 2 fiber. This sampler is a good example of what to expect when spinning suri fiber worsted from combed top. We make the following recommendations:

1) There be sufficient twist in your warp yarn to ensure that the warp yarns remain consistently balanced yet able to sustain the durability of the fabric and its pattern.

2) To ensure that the pattern you use has sufficient pics per inch to provide sufficient balance and durability for your fabric, but not too many to create a stiff or heavy hand. If not enough pics per inch (ppi) is used your pattern will look loose and not hold up with the wear and tear of normal use.

3) If using 100% suri any small inconsistency in the yarn will show in your finished product. The yarn is very slick, and difficult to spin consistently enough for a perfectly woven fabric. Any slubs, under-spun sections, or variations in yarn consistency will show in your fabric. Consider blending a small amount of a non-slick fiber to improve the spinning and weaving processes.

We believe this project is just the first of many more to come to enable us produce a high quality, mostly suri, fabric. We also look forward to the creation of new, more sophisticated small mill equipment that may respond to many of the current difficulties we face.

We thank the board of directors of the Suri Network for their support of this project, and hope that we have well served our membership in this venture. We also thank Liz Vahlkamp who provided lovely suri fiber for this project, Rachel Boucher for her processing of the fiber, and especially to Randy Loch at Lochs Maple for all the time and effort he took to comb and spin our 5 lbs of yarn. Thank you also to John Fowler for his effort in producing our sampler in time for our symposium and for his expertise in choosing appropriate patterns for the sampler. For more information or questions about this project, please feel free to contact Donna Rudd or Beth Brown, members of the SNPDC.
**Definition of terms:**

**Bloom**-When washed fabric has a thicker appearance, reduced shrinkage and a softer hand.

**Combed Top**- A continuous untwisted strand of wool fibers of predetermined length from which the short fibers (noil) have been removed in the combing process. Usually produced by carding, gilling and combing wool or fibres of similar length.

**Epi.**-Ends per inch, tells how many warp ends there are in one inch.

**End**-A single strand of warp.

**Floating Weft**-The weft yarn that extends without intersecting over two or more warps.

**Fulling**-A fabric finishing process, in which during the washing the weaves closes up and the yarns are brought closer together thereby shrinking the fabric.

**Grist**- The yards (or meters) per pound (YPP).

**Hand**-How a fiber, yarn, or fabric responds to human touch.

**Harness**- The frame containing heddles through which the warp is drawn.

**Heddle**-One of a set of vertical wires on a loom, each wire having an eye through which a warp then can be passed.

**Leno Finish**- A form of plain weave in which adjacent warp fibres are twisted around consecutive weft fibres to form a spiral pair, effectively ‘locking’ each weft in place.

**Ppi**-Picks per inch: wefts per inch

**Pick**-one pass of welt, often called a weft shot or just pick.

**Pilling**- The small collection of entangled fibers on a fabric surface

**Plied**- When yarn is spun, it is twisted into a single strand, A plied yarn has two or more strands twisted together, plied together.

**Reed**-The metal piece that fits into the beader of the loom, which is interchangeable. They determine how close together your warp threads will be. The reed and beater together push the weft into place.

**Selvedge**-The vertical edges of a fabric that don’t unravel.
**Semi-Worsted**- Mini Mills can use either length
The process is the same as woolen, but the rovings are then passed through the drawing machine. There is less fiber alignment than worsted, but more alignment than woolen.

**Warp**- The yarn attached to the loom, held under tension during the weaving process.

**Weft**- The horizontal yarn running from selvedge to selvedge, perpendicular to the warp.

**Woolen**- length in inches 1.5” – 3.75”
The fibers are carded in the same general direction. And then lightly spun

**Worsted**- length in inches 3.75” – 6”
The fibers are carded and then sent through a second process called a gilling machine or combs, which further align each fiber in a parallel direction and are all of a uniform length.