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Date: 7.19.2019
EXPLORING THE VERSITILITY OF ROMNEY

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To Olds College
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ABSTRACT/SUMMARY

The objective of this study was to demonstrate that Romney fiber is adaptable to many techniques and uses. Fibers were treated using a variety of methods to prepare (cutting short fibers, from rolags, sliver, and puni), spin (woolen, worsted), ply (2, 3, 4 plies), and finish (hot washing and rinsing, simmering, and fulling) sample skeins. Several pieces of equipment (cards, combs, hackle, and drop spindles) were used to create the sample skeins. The resulting skeins demonstrated a variety of twists per inch (TPIs) (average= 3.55; range= 2 - 6), wraps per inch (WPIs) (average= 14.52; range=6-22), and Bradford counts (average=5.21s; range=1s-10.6s), indicating a versatile fiber. These results were supplemented with a customer survey, again showing Romney fiber was used for a wide variety of purposes (outerwear, next to skin garments, art, and home goods) by customers purchasing fleeces. In conclusion, Romney was demonstrated to be both versatile and adaptable, and it would be interesting to duplicate this study using fiber from other breeds and compare the results.
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1. INTRODUCTION

1.1 Origin and History of the Romney Breed

The Romney breed of sheep originated in southeast England, specifically the Romney marsh of Kent. The marsh is 100 sq. miles of land that is below sea level kept habitable by ditches and seawalls that date back to Romans, according to Robson and Ekarius (2011). Developed in the 13th century, Romney is one of the oldest sheep breeds (Canadian Cooperative Woolgrowers Limited, 2014). Evolved from medieval long wool types, Romney fleeces became the most important export commodity of the area. In the middle ages these fleeces were so prized that wool smuggling was widespread (Australian Romney Association, Inc., 2016).

The first confirmed export was 20 sheep shipped to New Zealand in 1853 onboard the Cornwall, followed by another 30 ewes in 1856 (Wikipedia, 2016). In the 19th century the breed was improved with Leicester blood and by selective breeding. Today three quarters of all sheep in New Zealand are Romney (Wikipedia, 2016).

According to Robson and Ekarius (2011), Romneys were brought to North America in 1904 by William Ridell of Monmouth, Oregon. Both English and New Zealand lines are in present day Romneys. In the 19th century attempts were again made to improve the breed by selective breeding. This lead to what is referred to as old and new style Romneys. New style has a slightly smaller micron count (29-36), slightly more crimp, and less luster. Old style has a larger micron count (33-37), slightly less crimp, and more luster.

1.2 Characteristics of Romney sheep
The cold, wet, harsh climate of Romney Marsh shaped the breed characteristics. The breed is tolerant of harsh, wet conditions, with fleeces that are able to withstand heavy rainfall, resistance to internal parasites, and black hooves that are resistant to foot rot (Oklahoma State University, Department of Animal Sciences, 2015). These sheep also have high fertility with lambing rates of 140-170% and high proportion of twins and good mothering ability, easy lambing, and plentiful milk (Australian Romney Association, Inc., 2016).

Breed standard is described below as defined by the Australian Romney Association (2016). Males should appear masculine and weigh over 200 lbs, while females should be feminine and weigh over 150 lbs. The head should be carried high and be expressive with broad and level foreheads, prominent and alert looking eyes, coal black nostrils, and ears that are good-sized, velvety, and point outward not upward. Faces can be closed (wooly) or open (no wool), but horns are unacceptable. Romney fleeces can be white or various natural shades. Legs are straight—not bowed or knocked kneed. The legs below the wool line should be covered with hair (kemp) with black hooves (Raising Sheep, 2017).

1.3 Characteristics of the fleece

According to Breeds of Livestock from Oklahoma State University Department of Animal Sciences (2015), the Romney breed is classified as a long wool, with the smallest micron count in this group (27-36 µm). The average fleeces weigh 8-12 lbs with staple lengths of 4-8 inches. The fleeces can either be white or natural and are lustrous and hang in separate locks with minimal cross fibers. The fleece is also characterized by consistent micron counts and uniformity of crimp from the butt to the tip of the lock. Fleeces also have low grease, resulting in less shrinking upon washing; with typical clean yields, or weight of fleece after washing, of 75-80% of the original weight. These fibers can be spun from any preparation: carded, combed locks,
rolags, batts or in the grease. Romney fiber readily takes dye and has a broad range of uses, from rugs to sweaters.

1.4 Scope of project

The purpose of this study was to explore the versatility of the fibers from the Romney Sheep, a much-prized English breed. In order to test versatility, I utilized a variety of fiber preparations, spinning techniques, and finishing techniques to create 33 sample skeins. The twists per inch, wraps per inch and Bradford counts were measured for each sample skein to allow a more quantitative comparison. Additionally, each sample skein was evaluated by two experienced hand spinner to evaluate their potential uses. A customer survey was sent to customers who had previously purchased fleeces from Ramstead Ranch (Ione, WA) to provide an unbiased examination what others are doing with their Romney fleeces.
2. MATERIALS AND METHODS

2.1 Fleece acquisition

Fleeces for this project came from animals raised at Ramstead Ranch (Ione, WA). The fleeces were shorn from Princess, Prince George, Lily, and Lord Byron, as shown in Figure 1.

2.2 Sample skeins and knitted samples

I spun 33 skeins from the wool of four purebred Romney sheep. The fiber from Byron and Princess was commercially prepared into roving. I prepared the fiber from Georgie and Lily by dip washing, flick carding and combing. All blended yarns were 50/50 by weight. Spinning techniques included worsted and woolen from rolags, sliver and puni. I utilized the following equipment: cards, combs, flick cards, hackles, drop spindle, and spinning wheel. Finishing techniques included hot wash, rinse, simmering with washing soda and fulling. Technical characteristics were compiled for each skein including TPI, WPI and Bradford count. Further, skeins and knitted samples were evaluated for better comparison of hand, and tabulated the potential uses of each yarn.

2.3 Skein usage

In order to quantify the possible uses for the 33 skeins and samples that I produced, another experienced hand spinner and I considered the potential uses of each skein. The potential uses considered included: baby garment, shawl, lace, upholstery, tapestry, rugs, sweaters, outerwear, mittens, socks, hats, scarves, blankets, table mats or runners, hair accessories, ornaments, rope/cordage, toys, bags.
Figure 1: Cast of Characters. Pictures of the animals, fleeces, and fibers used in this study.

Princess has good luster with fine to medium crimp
Micron count = 32.8
Staple length = 5.5"

Prince George (Georgie) has a lustrous, silky fleece, variegated with shades of grey and a loose crimp.
Micron count = 35.5
Staple length = 7"
Figure 1 (continued): Pictures of the animals, fleeces, and fibers used in this study.

Lily’s creamy white fleece is lustrous with fine to medium crimp.
Micron count = 34.8
Staple length = 7"

Lord Byron’s fleece is lustrous and has variegated shades of grey with consistent medium crimp.
Micron count = 37.7
Staple length = 6"
2.4 Customer Survey

To ensure a more objective assessment of the possible uses of Romney fiber, I authored a survey using Google forms and distributed it to 47 customers who purchased one or more purebred Romney fleeces from Ramstead Ranch between 2013 and 2016. Results from the 21 clients who responded were compiled by Google forms.
3. RESULTS

3.1 Skein Characteristics

The skeins in the following pages are the product of the materials and methods previously described:
1. TRUE WORSTED
Fiber: Georgie
Prep: Locks were dip washed, then flick carded and combed. Combed locks were drawn off hackles with diz.
Spun: Root to tip: ZZS: worsted. Singles were reversed on bobbin, then plied root to tip
Finished: Hot wash and rinse
TPI 3: WPI 15: Angle 14 degrees
Bradford count: (l. / wt.) x 454 x (plies/FWS) = (11yds. / 4.7 gms.) x 454 x (2/560) = 3.8s
A true worsted yarn has a hard tough finish with the durability and strength needed for household item, warp or weft, as well as the warmth for outerwear.
2. TRUE WOOLEN
Fiber: Georgie
Prep: Locks were dip washed and combed. Long parallel fibers were used for worsted. Short fibers left behind were carded into rolags.
Spun: ZZS: woolen
Finished: Hot wash, rinse, and fulled
TRI 2: WPI 11: Angle 14 degrees
Bradford count: (l. / wt.) x 454 x (plies / FWS) = ( 12yds. / 6.8 gms. ) x 454 x ( 2 / 300 ) = 5.3s
A yarn spun woolen has warmth and insulation from air trapped in the fibers. However it has less durability, making it suitable for light wearing outerwear, or fluffy weft.
3. SEMI-WORSTED
Fiber: Georgie
Prep: Dip washed and combed, then carded into rolags.
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 4: WPI 14: Angle 21 degrees
Bradford count: \((\text{L.}/\text{wt.}) \times 454 \times (\text{plies}/\text{FWS}) = (12 \text{ yds.}/5.9 \text{ gms.}) \times 454 \times (2/560) = 3.3s\)

This yarn is more durable than woolen yet still warm, combining characteristics of both woolen and worsted
4. TPI 2
Fiber: Princess, roving
Prep: carded into rolags
Spun: ZZS, worsted, ratio 6
TPI s = TPIp x (plies + 1) / plies = (2x3) / 2 = 3
# treadles (singles) = (TPIs x dr. lg.) / ratio = (3x2) / 6 = 1
# treadles (plies) = (TPI p x dr. lg.) / ratio = (2 x 3) = 1
Finished: hot wash and rinse
TPI 2: WPI 7: Angle 27 degrees
Bradford count: (l./wt.) x 454 x (plies / FWS) = (11 yds./8.7 gms) x 454 x (2 / 560) = 2s
Spun with a TPI of 2, a yarn has softness and drape making it suitable for light wearing outerwear or weft.
5. TPI 4
Fiber: Princess
Prep: roving carded into rolags
Spun: ZZS, worsted, ratio 10
TPIs =(( TPlp x (plies + 1) ))/ plies = (4x3)/ 2=6
#treadles (singles) = (TPIs x dr.lgt.)/ratio = (6x10)/10 = 6
# treadles (plies) = ( TPlp x dr. lgth.) / ratio = (4x10) / 10 = 4
Finished: hot wash and rinse
TPI 4: WPI 12: Angle: 27 degrees
Bradford count = (l.yds x wt.gms) x 454 x (plies / FWS)= (12/6.2) x 454 x (2/560)= 3.2s
A yarn with a tpi of 4 has warmth, durability and elasticity for household goods, outerwear, warp or weft.
6. TPI 6

Fiber: Princess
Prep: roving carded into rolags
Spun: ZZS, worsted, ratio 14

TPIs = ((TPIp x (plies + 1))/ plies = (6x3)/2 = 9
Treadles (singles) = (TPIs x dr.lgth.)/ ratio = (9x3)/14 = 1.9
Treadles (plied) = (TPIp x dr.lgth.)/ ratio = (6x2.5)/ 14 = 1.07

Finished: hot wash and rinse

TPI 6: WPI 18: Angle: 21 degrees
Bradford count = (l. / wt.) x 454 x (plies / FWS) = (11 yds. / 2.6 gms.) x 454 x (2 / 560) = 6.9s

Finer and with more twist, this yarn is strong, durable, less elastic, and less soft. It is suitable for warp, weft, household goods, or even lace.
7. IN THE GREASE
Fiber: Lily
Prep: raw lock carded onto sliver
Spun: ZZS. Worsted
Finished: hot wash and rinse
TPI 2.5 : WPI 12 : Angle 21 degrees
Bradford count = (l. / wt.) x 454 x (plies / FWS) = (12 yds. / 5.3 gms) x 454 x (2/560) =3.7s
This yarn is warm and durable. With a slightly cooler wash, some lanolin can be retained to create some water resistance for fisherman sweaters.
8. DROP SPINDLE
Fiber: Byron
Prep: roving
Spun: ZZS, worsted, on drop spindle, transferred to bobbin, and plied on drop spindle
Finishes: hot wash and rinse
TPI 3: WPI 12: Angle 16 degrees
Bradford count = (l. / wt.) x 454 x (plies / FWS) = (11 yds. / 6 gms.) x 454 x (2/560) = 3s
Romney spins easily on a drop spindle for warm, strong durable outerwear, household goods, warp or weft.
9. LLAMA BLEND
Fiber: Byron and llama
Prep: Byron roving and llama top, 50/50 by weight, carded into rolags
Spun: ZZS: worsted
Finished: hot wash and rinse
TPI 3.5; WPI 16 : Angle 15 degrees
Bradford count = ( l. /wt.) x 454 x (plies/ FWS) = (11 yds. / 2.3 gms.) x 454 x (2/560) = 7.8s
The following characteristics of the blended fibers enhance the versatility of the Romney: warmth, bulk, soft hand, strength, drape.
10. SURI ALPACA BLEND
Fiber: Princess and alpaca
Prep: Princess roving and alpaca top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3 : WPI 12: Angle 27 degrees
Bradford count = (l. / wt.) x 454 x (plies/ FWS)= ( 11 yds. / 4.7 gms.) x 454 x (2/560) = 3.8s
The following characteristics of the blended fibers enhance the versatility of the Romney: soft hand, drape, warmth.
11. CAMEL BLEND
Fiber: Princess and baby camel
Prep: Princess roving, camel top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3.5: WPI 16: Angle 14 degrees
Bradford count = (l. / wt.) x 454 x (plies/FWS)= (11yds./3.2 gms.) x 454 x (2/560) = 5.6s
The following characteristics of the blended fibers enhance the versatility of
the Romney: warmth, strength, drape, soft hand, and decrease in felting.
12. MOHAIR BLEND
Fiber: Byron and mohair
Prep: Byron roving and mohair top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3: WPI 15: Angle 15 degrees
Bradford count = (l./wt.) x 454 x (plies/ FWS) = (11 yds. / 2.8 gms.) x 454 x (2/560) = 6.4s
The following characteristics of the blended fibers enhance the versatility of the Romney: smooth hand, halo, and luster.
13. ANGORA BLEND  
Fiber: Princess and angora  
Prep: Princess roving and mohair top, 50/50 by weight, carded into rolags  
Spun: ZZS, worsted  
Finished: hot wash and rinse  
TPI 4.5: WPI 16: Angle 21 degrees  
Bradford count = (l./wt.) x 454 x (plies/FWS) = (11yds. / 3.4gms.) x 454 x (2/560) = 5.3s  
The following characteristics of the blended fibers enhance the versatility of the Romney: warmth, decreased elasticity, lightness, water repellence.
14. CASHMERE BLEND
Fiber: Princess and cashmere
Prep: Princess roving and cashmere top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3.5: WPI 14: Angle 25 degrees
Bradford count = (l. / wt.) x 454 x (plies/ FWS)= (11 yds./ 3.4 gms.) x 454 x
(2/560) = 5.3s
The following characteristics of the blended fibers enhance the versatility of
the Romney: warmth, light weight, low shrinkage, absorbency, elasticity, soft
silky hand.
15. YAK BLEND
Fiber: Byron and Yak
Prep: Byron roving and yak top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 4: WPI 12: Angle 20 degrees
Bradford count = (l. / wt.) x 454 x (plies/FWS) = (11 yds. / 3.6 gms.) x 454 x (2/560) = 5s
The following characteristics of the blended fibers enhance the versatility of the Romney: warmth, soft hand.
16. BISON BLEND
Fiber: Georgie and bison
Prep: Georgie combed locks and bison top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 5: WPI 13, Angle 27 degrees
Bradford count = (l. / wt.) x 454 x (plies/FWS) = (11yds./ 4.1 gms. ) x 454 x 
(2/560) = 4.4s
The following characteristics of the blended fibers enhance the versatility of
the Romney: warmth, soft hand, decreased shrinkage.
17. SILK BLEND
Fiber: Princess and silk
Prep: Princess roving and tussah silk top, 50/50 by weight, carded into sliver
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3.5; WPI 14, Angle 21 degrees
Bradford count = (l./wt.) x 454 x (plies/ FWS) = (10 yds./2.6 gms.) x 454 x (2/840) = 4.2s
The following characteristics of the blended fiber/s enhance the versatility of the Romney: warmth, absorbency, luster, soft smooth hand, strength, drape, resistance to felting.
18. COTTON BLEND
Fiber: Byron and pima cotton
Prep: Byron roving cut in half and cotton top, 50/50 by weight, carded into puni
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 4: WPI 12: Angle 21 degrees
Bradford count = (l. /wt.) x 454 x (plies/FWS) = (11 yds./ 4.5 gms) x 454 x (2/840) = 2.6s
The following characteristics of the blended fibers enhance the versatility of the Romney: ease of washing, softness.
19. FLAX BLEND
Fiber: Princess and line flax
Prep: cut line flax into 5 inch pieces, carded with Princess roving, 50/50 by weight into sliver
Spun: ZZS, worsted
Finished: simmered 1 hour with soap and washing soda
TPI 2.5: WPI 13: Angle 27 degrees
Bradford count = (l./wt.) x 454 x (plies/FWS) = (l1 yds./ 5.3 gms x 454 x (2/300) = 6.3s
The following characteristics of the blended fibers enhance the versatility of the Romney: strength, absorbency, quick drying, low elasticity, drape, low shrinkage.
20. HEMP BLEND
Fiber: Byron and hemp
Prep: Byron roving and hemp top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 2.5: WPI 14: Angle 27 degrees
Bradford count = (l. / wt.) x 454 x (plies/FWS) = (11 yds. / 4.2 gms) x 454 x (2/560) = 4.3s
The following characteristics of the blended fibers enhance the versatility of the Romney: strength, durability, antimicrobial, breathable, absorbency.
21. BAMBOO BLEND
Fiber: Lily and bamboo
Prep: Lily combed locks and bamboo top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3.5: WPI 15: Angle 21 degrees
Bradford count = (l./wt.) x 454 x (plies/ FWS) = (11 yds. / 3.5 gms) x 454 x (2/560) = 5.1s
The following characteristics of the blended fibers enhance the versatility of the Romney: sheen, soft hand, resistance to bacteria, absorbency, breathable, warmth.
22. RAMIE BLEND
Fiber: Lily and ramie
Prep: Lily combed locks and ramie top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 2.5: WPI 18: Angle 14 degrees
Bradford count = (l./wt.) x 454 x (plies/FWS) = (11yds./3.2 gms.) x 454 x (2/560)
= 5.6s
The following characteristics of the blended fibers enhance the versatility of the Romney: absorbency, quick drying, minimal shrinkage, low elasticity, easily laundered.
23. NYLON BLEND
Fiber: Lily and nylon
Prep: Lily combed locks and nylon top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 5: WPI 18: Angle 21 degrees
Bradford count = (1./wt.) x 454 x (plies/FWS)= (11 yds./ 1.7 gms) x 454 x (2/560) = 10.6s
The following characteristics of the blended fibers enhance the versatility of the Romney: strength, resistance to abrasion, elasticity, drape, water resistance.
24. RAYON BLEND
Fiber: Lily and rayon
Prep: Lily combed locks and rayon top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TRI 4: WPI 22: Angle 14 degrees
Bradford count = (l. /wt.) x 454 x (plies/FWS) = (11yds. / 2 gms) x 454 x ( 2/560)
= 9s
The following characteristics of the blended fibers enhance the versatility of the Romney: drape, good heat conduction, absorbency.
25. TENCEL BLEND
Fiber: Lily and tencel
Prep: Lily combed locks and tencel top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3: WPI 22: Angle 10 degrees
Bradford count = (l./wt.) x 454 x (plies/FWS) = (11 yds./2.2 gms.) x 454 x (2/560) = 8.2s
The following characteristics of the blended fibers enhance the versatility of the Romney: strength, ease of washing, low shrinkage, drape, absorbency, soft hand.
26. CORN BLEND
Fiber: Lily and corn
Prep: Lily combed locks and corn top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3: WPI14: Angle 16 degrees
Bradford count = (l./wt.) x 454 x (plies/FWS) = (11 yds. / 4.3 gms.) x 454 x (2/560) = 4.2s
The following characteristics of the blended fibers enhance the versatility of the Romney: absorbency, breathable, flame resistance, drape.
27. SOY BLEND
Fiber: Georgie and soy
Prep: Georgie combed locks and soy top, 50/50 by weight, carded into rolags
Spun: ZZZS, worsted
Finished: hot wash and rinse
TPI 3.3: WPI 16: Angle 14 degrees
Bradford count = ( l. / wt.) x 454 x (plies/FWS) = (11 yds./3.9 gms) x 454 x (3/560) = 4.6s
The following characteristics of the blended fibers enhance the versatility of the Romney: luster, drape, absorbency, strength, ease of washing
28. MILK BLEND
Fiber: Lily and milk
Prep: Lily combed locks and milk top, 50/50 by weight, carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 3.5: WPI 16: Angle 21 degrees
Bradford count = (I./ wt.) x 454 x (plies/FWS) = (11 yds./ wt,) x 454 x (2/560) = 4.7s
The following characteristics of the blended fibers enhance the versatility of the Romney: luster, drape, strength, ease of washing, absorbency.
29. SEACELL BLEND
Fiber: Lily and seacell
Prep: Lily combed locks and seacell top, 50/50 by weight. Carded into rolags
Spun: ZZS, worsted
Finished: hot wash and rinse
TPI 4: WPI 13: Angle 27 degrees
Bradford count = (l./wt.) x 454 x (plies/FWS) = (11 yds. /5.960 x 454 x (2/560)
= 3s
The following characteristics of the blended fibers enhance the versatility of
the Romney: luster, drape, strength, ease of washing, absorbency.
30. TAIL SPUN
Fiber: Lily and Georgie
Prep: Lily combed locks and Georgie combed locks, Georgie cut into small pieces
Spun: ZZS (core), worsted, small pieces placed into ply
Finished: hot wash and rinse
TPI (core) 5: WPI 6: Angle (core) 39 degrees
Bradford count= (l./wt.) x 454 x (plies/FWS) = (10 yds/15.8 gms.) x 454 x (2/560) = 1s
This fun yarn can be for trim, fuzzy blankets, or hair ornaments.
31. MARL
Fiber: Lily and Georgie
Prep: Lily combed locks and Georgie combed locks
Spun: ZZS, 1 single Lily, 1 single Georgie, worsted
Finished: hot wash and rinse
TPI 4 : WPI 20: Angle 14 degrees
Bradford count = ( l. /wt.) x 454 x ( plies/FWS) = (11 yds. /2.5 gms.) x 454 x (2/560) = 7.2s
Warm and durable this yarn could be used for outerwear, household goods, or woven.
32. CABLE
Fiber: Georgie and Lily
Prep: Georgie combed locks and Lily combed locks,
Spun: ZZS → :SSZ, worsted
Finished: hot wash and rinse
TPI 3: WPI 13: Angle 7 degrees
Bradford count = (l./ wt.) x 454 x (plies/FWS) = (11 yds./4.9 gms) x 454 x (4/560) = 7.3s
A cabled yarn with strength, durability, and less elasticity can be used for cordage, braiding, knitted into garments, or woven.
33. NAVAJO PLY
Fiber: Lily and Georgie
Prep: Lily combed locks and Georgie combed locks
Spun: ZZZS, worsted, Navajo ply
Finished: hot wash and rinse
TPI 4.3: WPI 18: Angle 14 degrees
Bradford count = (1./wt.) x 454 x (plies/FWS) = (11 yds./2.9 gms.) x 454 x (3/560) = 9.2s

A fun yarn for preserving color change, this yarn could be used for garments, or household goods.
3.2 Comparison of Skein Characteristics

Histograms for each of the parameters measured for each sample skein, including blends, are shown for TPI (Figure 2), WPI (Figure 3), and Bradford count (Figure 4). To some extent, each of these plots displays a normal distribution curve, with more skeins having values near the average and median values shown in Table 1. However, each parameter also showed a wide range of variability.

| Table 1: Sample Skein Comparison. Average, median and range for TPI, WPI, and Bradford count |
|---------------------------------|-------|------|------|
|                                 | Average | Median | Range |
| TPI                             | 3.55   | 3.5   | 2-6   |
| WPI                             | 14.52  | 14    | 6 - 22 |
| Bradford Count                  | 5.21s  | 5s    | 1s - 10.6s |

Taken together the final bubble graph displayed what appeared to be a random scatter pattern (Figure 5). So by changing multiple variables, TPI, WPI and blends, it is possible to expand the variability of Romney fiber. The spinner is then able to place the skein nearly anywhere on the grid, expanding versatility.

3.3 Evaluating Potential Uses of Skeins

After evaluating the skeins and knitted samples, I tabulated the possible uses for each yarn (Table 2). It was possible to produce a Romney or Romney blend yarn that fulfilled every need. To increase the versatility of Romney, I used both techniques and blends. For example, to achieve better next to skin or baby uses I blended with fibers that had lower micron counts, greater softness and drape such as cashmere, or downs. To achieve hard-wearing, tough yarns
suitable for rugs, I blended strong fibers such as synthetics or bast fibers, or I used techniques that produced a tough, hard finish such as worsted, semi-worsted, or cabled. For rope or cordage I used fiber blends with strength and less elasticity such as hemp or flex or I used techniques such as cabling.
Figure 2: TPI. Number of skeins at each TPI

Figure 3: WPI. Number of Skeins at each WPI
Figure 4: Bradford Count. Histogram of Skeins by Bradford Count
Figure 5: Overall versatility. Versatility of Romney fiber based on TPI, WPI, and Bradford counts of skeins. Larger bubbles indicate lower WPI.
Table 2: Potential skein uses. Potential uses of each sample skein as evaluated by experienced handspinners.

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3.4 Customer Survey

The following represent the aggregated responses from the 21 clients who purchased Romney fleeces from Ramstead Ranch (Figure 6). These responses lend insight into how spinners and other fiber artisans worked with Romney fleeces. Nearly all respondents had worked with their fleeces at the time of the survey. Most scour washed their fiber (58%), but a variety of carding methods were used. Most respondents were spinners using a traditional spinning wheel (95%) and knitted their final products (83%). The spinning methods were quite varied and there were also a large variety of finished products, including 45% reporting other uses. Customers who reported other specified the following alternative projects: shawl, inkle bands, tail spun art yarn, sweaters, and cowl. Other information collected on products, but not plotted in the survey graphs, included: many sweaters, socks, art yarn for sale, outerwear (cowls, hats, and mittens), and one blanket.

Figure 6: Customer survey results. Results from Ramstead Ranch Customer survey (21 responses)

Have you done anything with your Ramstead Ranch fleece? (21 responses)

- Yes
- Not yet (Thank you for participating in this survey, you're done!)
How did you wash your fiber? Check all that apply. (19 responses)

- No wash: 3 (15.8%)
- Dip wash: 1 (5.3%)
- Scour wash: 11 (57.9%)
- Machine wash: 1 (5.3%)
- Other: 4 (21.1%)

How did you prepare your fiber? Check all that apply. (20 responses)

- No preparation: 7 (35%)
- Hand card: 6 (30%)
- Drum card: 8 (40%)
- Flick card: 5 (25%)
- Comb: 5 (25%)
- Hackle: 2 (10%)
- Commercial: 4 (20%)
- Other: 2 (10%)

What tools did you use to spin your fiber? Check all that apply. (20 responses)

- I did not spin the fiber: 1 (5%)
- Drop spindle: 2 (10%)
- Supported spindle: 0 (0%)
- Spinning wheel: 19 (95%)
- Commercially spun: 0 (0%)
- Other: 0 (0%)
What technique(s) did you use to spin (if applicable)? Check all that apply. (20 responses)

- Woolen technique: 4 (20%)
- Worsted technique: 10 (50%)
- In the grease: 6 (30%)
- Single ply: 5 (25%)
- 2-Plyed: 13 (65%)

What techniques did you use to prepare your finished products? (18 responses)

- Felted: 0 (0%)
- Knitted: 15 (83.3%)
- Crocheted: 1 (5.6%)
- Woven: 5 (27.8%)
- Other: 2 (11.1%)

What finished products did you create? Pick the choices that best describe your product (18 responses)

- Next to skin garment: 9 (50%)
- Outerwear: 8 (44.4%)
- Accessories: 7 (38.9%)
- Household goods: 1 (5.6%)
- Braided, ropes, cordage: 0 (0%)
- Toys: 0 (0%)
- Art: 2 (11.1%)
- Other: 8 (44.4%)

Customers who reported other specified the following alternative products: shawl, inkle bands, tail spun art yarn, sweaters, and cowl.
4. CONCLUSION

The goal of this project was to explore the versatility of Romney fibers by preparing a variety of sample skeins (33) and collecting a consumer survey reporting on Romney fiber uses. The fibers in the test skeins had a wide range of TPI, WPI, and Bradford counts, indicating that the fiber was very versatile. The suitability of each sample skein for a variety of uses was evaluated and at least some skeins were suitable for each intended use and most skeins were suitable for multiple and varied uses. The versatility of Romney fleece in sample skeins was consistent with the many ways spinners who responded to the customer survey approached Romney fleeces to produce a range of products. The Romney breed, adapted to thrive in a range of harsh environments, provides fiber that is incredibly versatile.
5. ACKNOWLEDGEMENTS

In the course of preparing the study I enlisted the help of my own personal Geek squad:
daughter Sarah Hayes PhD, for survey design and data analysis, and Eileen Napier, head
shepherdess and co-owner of Ramstead Ranch for help with photography, micron counts, and
computer programs. I also appreciate the support of the Ramstead customers who purchased
fleeces and were willing to participate in my study.
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