CASH MIRROR

Volume 9, Issue 11 September 1998

The monthly magazine devoted to cashmere goats and their fiber

Table of Contents

CASHMIRROR

ISSN 1090-736X

Technical Information

This magazine is published each month by:
CashMirror Publications
2280 S. Church Rd.
Dallas, Oregon 97338
503-623-5194
Fax: 503-624-1704
E-Mail: goatknol@teleport.com
Home Page: http:// www.teleport.com/~goatknol

Publisher and Ace Reporter:
Paul Johnson
Editor: Linda Fox
Eastern Correspondent:
Linda Cortright
N. Rocky Mountain Correspondent:
Yvonne Zweede-Tucker

Opinions expressed in this magazine are not necessarily those of the publisher or of the attractive staff, although some of them might be. *CashMirror* limits (as much as possible) its liability for errors, inaccuracies or misprints in advertisements, opinion papers and letters to the editor. Advertisers assume liability for the content of their advertising and assume responsibility for claims made in connection with their advertising. In case of error, the publisher is responsible only for costs associated with the space occupied by the error.

Results published in the magazine are from information supplied by clubs and organizers and no responsibility for complete accuracy can be taken although we'll certainly try to get it right the first time.

The *CashMirror* welcomes contributions of articles and photographs. Submissions may be made by mail, fax or e-mail.

No responsibility will be taken for material while in transit or in this office, although we will certainly be real careful.

Cover photo by:
Marilyn Ackley, Bessey Place Cashmere
"Legends of the Fall"

Finally! Another Contest! What Do *You* Do with All that Guard Hair?

This contest is an attempt to prove that cashmere goat owners, like the rest of the earth-conscious folk, are making an effort to make clever use of their trash. We want to know of uses for guard hair.

We found a bird's nest lined with goat hair. The birds did a good job of twining the hair inside, but we had to wonder why they didn't use the down instead? Perhaps if we'd lived further north, they would have. Maybe they were birds on a budget.

Anyway, what clever uses do you have for guard hair?

As usual, the contest will have glorious prizes and we'll publish some of the ideas.

Contest deadline: December 31, 1998.
To enter: Send us your idea—mail, email, fax, whatever. You don't need to be a subscriber, or an adult to enter, or even own a goat; you just need to be able to come up with a good idea.
Judging: Winners will be chosen by a panel of judges, chosen by *CashMirror*, to include one cashmere goat person, one adult who is not a goat person and a child (probably a teenager).
Winner: To be announced in January 1999 *CashMirror*.
Prizes: First prize: One gorgeous, white, lacy, handspun, handmade crocheted cashmere scarf (see description on page 10, this issue)—scarf photograph will be in next issue. **Second Prize:** A one year subscription (or subscription extension) to *CashMirror*. **Third Prize:** One 1999 *CashMirror* calendar.

Could you make toupee's for balding men so they wouldn't have to wear hats?

Dave

Would guard hair make a good bed for your favorite llama?

Maybe you could spin it not-so-fine and make something lumpy? Photograph is of John Mionczynski at 1996 Cashmere Wyoming Conference trying his hand at spinning cashmere.

Correction to Coming Attractions—Last Issue

You won't find many numbers with $ in front of them this issue, so don't look. The money stuff will be next issue. For those of you who really like numbers and are disappointed, don't worry—there are plenty of numbers in this issue, but they're more of the statistical variety. Unfortunately, the staff burned themselves out on these numbers and had no brains (or space) left for the $.

Reflections

by Linda Fox

Encouraging Social Graces in Young Does

When weaning the last of the kids this year, we noticed that most of our kids weren't as friendly as in prior years. This is most likely a function of more kids and thus, less time spent with them when they are young. There is only so much people-time to go around and as numbers grow, per-kid attention by the humans decreases. It helps us in handling older goats if they can be manipulated easily with grain. Also, if they are more comfortable with human presence, we feel that handling them for regular maintenance is less stressful for them—and certainly easier on us!

The young wethers and bucklings were separated out and moved to one pasture, and the young doelings were moved to the smaller pasture between the barn and the house. We would keep the twenty remaining young ladies close to us so we could spend time with them and get them used to us friendly humans.

For the first week, I introduced them to grain on a regular basis, let them get used to the trauma of no mommy/no milk, and pretty much left them alone.

By the second week, the girls didn't seem to mind when I walked into their pen in the evening to leave their allotment of hay and grain. They were starting to pick up rudimentary social graces—whenever they saw me, they licked their lips—a sign of recognition is a start.

Since our weather has been extremely dry for two months, their small outdoor pasture had been quickly eaten down to dry stubble. By the third week, I decided that the girls were ready for bigger territory and also could use some fresh greens added to their dry diet. I opened the gate to their pen which allowed access to a small woods behind the house and also to the driveway. I expected a (small, short) thundering herd to leave me in a cloud of dust on its way to the allure of the green vines in the woods. At least that would have happened with older goats. The girls huddled timidly in the middle of their pasture.

I tried alternatively to chase and lure them out of the pen. They had become unafraid enough that they couldn't be chased effectively. And, they weren't yet fond enough of me to follow—a herd of young goats caught between "Hello" and "Good-bye."

After much frustration, I realized, as I always eventually do with goats, that, as the species with the superior intelligence, I must outwit them.

I chose an older doe from the doe herd who did not have kids in the group and who *would* follow me, especially if I had a flake of hay under my arm. Fancy followed me dutifully out of the pen to the woods behind the house, and the little girls dutifully followed Fancy. An older goat can be trusted, while a human has to be watched!

When Fancy had her fill of the forest, she led the group back to the pen. I used Fancy as the herd leader the next day as well, but found that she was no longer content to head for the woods, but wanted to head down the driveway toward the barn and the pond. However, Fancy was still easy to retrieve any time I wanted—all I had to do was call her and she would come running up the hill with her herd of young ladies behind her.

After that second day, the doelings waited at the gate in the morning until I opened it for them. They trotted off to the woods to graze, sometimes making the short trip down to the barn and then returning to their pen so I could close the gate for the night. I cut back on their hay and grain, feeling good that they were getting more of their sustenance from green growing plants.

Our little girls are becoming quite social. They have become comfortable with my presence and don't mind if I sit with them in the woods while they browse. Most of them come up to check me out and several of them like to be petted. They have made friends with Mickey, the cat, and Mittens, the pig. If I want them back in the pen before they are ready to go, they will generally follow me back in with little encouragement.

Yesterday, at the end of the day, I went outside to collect the girls to put them away for the evening. They weren't in the woods; they weren't down by the barn. They couldn't have easily escaped so I followed the driveway down the hill. I found them 1/2 mile away, lying in the yard of the old house, ruminating and belching! The flock of sheep were keeping them company on one side (across the fence) and the big bucks on the other side of them were no doubt telling them things they were too young to know. Fortunately, they were across a fence as well! I'm afraid our little girls may have become overly socialized.

I tried to lead them back up the hill, but they weren't interested in leaving. They had found fallen plums to nibble on next to the sheep and half-rotten apples by the road. They had also found a nice cool hideaway under the cedar trees next to the neighbor's house. I had lost control. I had merely tried to give the young girls a few social graces and they had become a herd of goats!

When Readers Talk...

Hello there,

We are already subscribers to CashMirror and enjoy it very much. I am looking for an article on dehairing cashmere by hand, and also someone I might speak with (email is fine) who can answer some questions on how to select cashmere goats. We have 4 grown does and their 3 doelings, as well as 2 bucklings, one of which we wethered, and of course, he is just loaded with cashmere now! So it certainly looks like we made the wrong choice there!

We will be choosing 2 new does this fall, as well as borrowing a breeding buck. I feel like we have learned a little in the past 2 years, but would like a pen pal of sorts who would be willing to help a little.

That might be a good thing for your magazine--round up a list of experienced breeders who are willing to be mentors to us newbies.

Appreciate any direction you can give.

Deb Steinberg
NICKERS & NEIGHS (Wildberries Farm)
Rt. 4, Box 174E
Whitesboro, Texas 76273
email: deb@nickers.com

August 23, 1998

Any interest is us publishing a list of "Newbies Needing Mentors" or "Mentors Accepting Newbies" lists? Give us feedback if you have an interest. We would be willing to publish such a list--A matching service for cashmere folk. We could do it like the "Personal Ads."...small, blonde NGP (new goat person) wishes to find EGP (experienced goat person) of either sex for long emails about goat-related subjects. Purpose is friendship, but could lead to a more serious relationship involving...

Dear Editor,

You may not remember me, but I was the cute kid featured on page 19 of the July 1998 CM. I was captured balancing on my mother's back. The photo caption indicated that I wanted to join the ranks of the Trick Goats when I grew up.

However, after carefully examining the centerfold of the July issue filled with photos of Trick Goats, I want to draw your attention to the large photo in the center of the page which appears to be a young buck balancing on an older buck's back.

I think you should do some investigative reporting here! It looks to me like you may have been taken in by a clever Trick Photographer!

The Real Trick Goat (in training)
Dorothy
September 14, 1998
Goat Knoll, Dallas, Oregon

Goats and Minerals

The following page contains two tables--Table of Symptoms of Mineral Deficiencies in Young Goats and Minimum Mineral Requirements of Goats.

These two charts are from the Delaware Cooperative Extension Service and were retrieved (and formatted neatly) from their internet page at: http://bluehen.ags.udel.edu/deces/goatmgt/gm-03.htm
They, along with 10 other tables (of varying degrees of usefulness to the average cashmere goat owner) were part of an article entitled Recent Advances in Mineral Nutrition of Goats. This article can be found starting on page 19 of this issue.

You should consult your Veterinarian when attempting to diagnose and treat any mineral deficiency or excess in your livestock.

Table of Symptoms of Mineral Deficiencies in Young Goats

	Mineral													
Symptom	**Ca**	**P**	**Mg**	**Se**	**K**	**S**	**Fe**	**Cu**	**Mo**	**Co**	**Zn**	**Mn**	**I**	**NaCl**
Growth slow	x	x	x	-	x	-	x	x	x	x	x	x	x	x
Appetite less	x	x	x	-	x	x	x	x	x	x	x	-	x	x
Reproduction less	x	x	-	x	-	x	x	x	-	x	-	x	x	-
Offspring weak	x	x	-	x	-	-	x	-	-	-	-	x	x	x
Milk less, (adult)	x	x	-	-	x	-	-	x	-	x	x	-	x	x
Other effects:														
alopecia											x		x	
anemia							x	x		x				
ataxia				x				x		x		x		
cachexie								x		x	x			
cardiac problems				x										
dermatosis											x			
diarrhea				x						x				
dyspnea				x										
estrus irregular												x		
goiter													x	
heat stress					x									
hoof deformation											x			
milk fever	x		x											
osteophagia		x												
pica								x		x				
rough hair														x
skeletal deformation								x			x	x		
spontaneous fracture								x						
staring								x			x	x	x	
stillbirth								x						
tetany			x											
weak, dull						x								
white muscle dis.			x											

x = positive (Too little) - = negative (Too much)

Minimum Mineral Requirements of Goats

Mineral	Maintenance mg/kg BW/d	Pregnancy g/kg fetus	Lactation g/kg milk	Growth g/kg BW	Absorption percent
Ca	20(a)	11.5	1.25	10.7	30
P	30(b)	6.6	1.0	6.0	65
Mg	3.5(c)	0.3	0.14	0.4	20
K	50(d)	2.1	2.1	2.4(f)	90
Na	15(e)	1.7	0.4	1.6(f)	80
S	0.16 percent of DM intake if protein = 10 percent, 0.32 percent of DM intake if protein = 20 percent				
Fe	30 - 40 - 100 mg/kg DM/d				
Cu	8 - 10 - 23				
Co	0.1 - 0.15				
I	0.1 - 0.4 - 0.6 - 0.8				
Mn	20 - 40				
Zn	10 - 50				
Se	0.1 - 0.2				
Mo	0.01 - 0.1				
Ni	300 - 350 mcg/kg DM/d				
V	10 - 25				
Li	> 2				

(Kessler, 1991; Haenlein, 1987)

(a) 0.7 percent of DM intake if at 3 percent of BW
(b) 0.5 percent of DM intake
(c) 0.2 percent of DM intake
(d) 0.5 percent of DM intake
(e) NaCl 0.5-0.6 percent of DM intake
(f) 0.4 when 32 kg BW or more

Introducing Yvonne Zweede-Tucker

New North Rocky Mountain *CashMirror* Correspondent

Yvonne Zweede-Tucker is well-known and well-respected in cashmere goat circles. We first met her in 1995, at the PCMA conference in Bozeman, Montana, and again at the 1996 Cashmere Wyoming conference. Yvonne gets around. You've read Yvonne's stories in this publication before—including "How to Hotwire a Goat," a great article on fencing in the December 1997 issue, how to construct a "Goat "Show-mobile" from nothing more than a beat-up camper shell and "Why the National Western?" in the February 1998 issue. When we were searching for a center of the world (or at least middle of the US) correspondent, we immediately thought of Yvonne. She knows a lot, has a large herd of cashmere goats and she's had them for quite a while. What more could you ask for? Here is the results of Yvonne's first assignment—an introduction of herself and her ranch:

Welcome to Smoke Ridge Cashmere!

Story and photographs by Yvonne Zweede-Tucker

Four years B.C. (before Craig), I read an article in the *Ranch Magazine* about Bron Schuetze, her then-partner Jill Darrah, and the nascent North American cashmere industry. Here was a combination of a fiber that had been in short supply for hundreds of years, a meat that was currently in short supply, and almost legendary weed-eating capabilities. The fact that all this came packaged in a critter that no one seemed to know much about proved too tempting for my natural desire to be different (without getting into exotics). I had been looking for a way out of corporate America and the Big City, and now, by George, I'd got it! (Luckily, I also dreamed up another business to pay the bills until the goats started supporting me. More on that later.)

Finally, I was living outside of Kalispell, Montana, and in April 1991, thirty Spanish does with *lots* of potential arrived to share my acreage. Cashco bucks added fiber and frame size to the herd, including the magnificent white import, Austco Envoy. In my earliest learning curve days, I peppered Bron with a seemingly endless list of questions. Now I just leave her endless messages!

In late 1992, I relocated to an even smaller town in Montana, and there was an unexpected bonus in the "boy next door." First Craig was a goat-sitter when I had to travel, then an able goat-assistant, then romance bloomed In 1995, we were married. No goats at the ceremony, but Jolene and Smiley were featured in a poem composed by my uncle.

Craig got a Junior High mathematics teaching job in Choteau, Montana (setting of the book, Horse Whisperer, although not the movie) and having now built a home together, we won't be moving again. Ever! Craig's teaching and three seasons of coaching, my "day job" of custom sewing for furniture stores and the revenue from the goats all added together allowed us to acquire 223 hillside dryland acres with a spectacular view west toward the Rocky Mountains.

The doe herd now numbers close to 200, on the way to a maintenance level of approximately 250 females. Our focus is on vigor (we can have two weeks of 40 degrees below zero without wind chill), maternals, carcass quality, growth, and fiber. Yes, in that order—watch for next month's article on *our* breeding objectives based on *our* financial reality. The criteria to stay off of the culling list here are simple:

Continued on next page

Doe herd heading out to pasture—400 or so including kids.

Smoke Ridge

Continued from previous page

make babies, have them and raise them, with a good attitude, and without undue human interference. We will assist in problem births (2 out of 200 this year) but do not jug or otherwise assist the does to do their jobs. With 40 kids being born per day last spring, and Craig at school, the notebook with the "hit" list was always close at hand!

Of the property, approximately 50 acres are in hay (which a neighbor cuts, bales and stack for us), about 100 in pasture, and 70 still in CRP (conservation reserve program). We have barely started to subdivide for optimizing pasture productivity, but notice the benefits where we have. The pastures and alleys are all fenced with aluminum electric fence, either two or three strands, or a single offset at the base of the perimeter barbed wire fences. Three-sided sheds, open to the south (4' high, 8' deep, 16' long) are all the shelter that the goats currently have, although a barn is on the wish list. We told the goats not to hold their breath this year!

The does come into their pen/shed area of their own accord, in the evenings, and we close their gate so that the guard dogs can eat in peace. The handling pen opens off the main pen, which gets subdivided during breeding season to allow for different sire groups. Toys (old telephone wire spools, etc.) keep the kids and least grown-up of the does occupied in the evenings and early mornings.

We feed our grass-alfalfa mix hay in the winter months (November - May) at approximately 4% of body weight, preferably in two feedings per day. Calf pellets are used for socialization purposes, and no other concentrates are fed. About eight blocks of mineralized salt with selenium are set out at a time until they are gone. Ivomec pour-on is used for worming, twice per year. Kidding is targeted for mid to late April, to coincide with availability of quality pasture, and so that the kids are grazing voraciously when the summer pasture flush hits (early July). Destocking through sales of wethers and production does starts in mid-August, as vegetation growth slows down.

We have never had floppy kid syndrome, do not give any shots to newborn kids, and lost only two kids out of 298 this year—one premature and one whose dam misplaced him, and will therefore go for slaughter. Caseous lymphadenitis was a serious problem among the first does acquired. I learned how to treat the abscesses and had an autogenous bacterin made, which protected the youngest goats until the original does had been culled or had proven themselves "clean."

Brutus, the Maremma, and Vita, the Anatolian Shepherd, guard the does from prowling coyotes and

The buck horde

kids from eagles and ravens in the spring. The bucks are usually unguarded—Would you bite a 250-pound, very smelly animal with long horns? We have never lost any animals to predators, but Vita is making a dent in the grasshopper population. I can credit getting into goats to the two Anatolians that I had before moving to Montana—they are the reason I was reading *Ranch Magazine* and saw the article that changed my life!

I have always considered the National Western Stock Show (in Denver in January) my annual "recharge," to be together with everyone and talk goats and pick brains and check out animals others brought. I feel that, at least for us cashmere breeders, the NWSS still functions as stock shows did originally: "Here's what I bred that I'm proud of; how am I doing?" and "Wow, that sire of yours would complement my females nicely (or vice versa)." This past January I thought I would burst with pride when first a doe kid and then a buck kid placed at the top of their classes, and then The Kapok Kid ("Elvis") led his class, and then took top buck honors. To place ahead of Bron, Kris McGuire and the others—I don't think Elvis' lead rope was holding him as much as it was keeping me from floating away!

We're pretty proud of most of our goats, but there is always something that can be improved on every one. And that's why we go out on goat visits together, and I go to Denver and Farm Fair International in Edmonton, where Pat Fuhr started the Goat Gala. (I drive, and poor Craig gets to stay home and do chores on top of teaching and coaching!) We continue to look for the attributes that would keep us moving on the road toward our "perfect animal." Maybe the revital-

Continued on next page

Smoke Ridge
Continued from previous page

ized CaPrA will even get the mandate to organize a North American buck register whereby we could assess available sires and choose the package of attributes needed for our breeding objectives.

The past few years have been exciting as well as frustrating, and I think that the coming years will bring even more challenges, but also opportunities for those of us who believe in the goats. The added bonus of doing something wholesome with great emotional rewards is that "quality of life" which many of us are searching for. Plus, as a GGF (good goat friend) said recently, "The quickest way to clear your head and get focused on what's really important (survival) is to walk out to the goats with a bucket of treats!"

It seems as though those of us who have stuck with it through recent years are somewhat more cooperative than we may have been previously. As a WGF (wise goat friend) has helped me to see, it's very OK if someone does something differently than Craig and I do here. It's neither our responsibility nor right to try and change their mind. We need to be secure in what we believe in and allow others to follow their own road. We might even learn something from them. For example, we shear our goats. Others find it easier to comb. It's up to the fiber buyers to deal with the differences in the fleeces. If there are shorn and combed fleeces entered in a competition or evaluation, let the judge sort it out. Let's not preclude others from doing something they wish to do. We all have enough to do ourselves.

Thanks for visiting us through this article! If your road takes you near Glacier National Park or Yellowstone, please know that GP's (goat people) are always welcome to visit in person. Just call for directions.

Yvonne & Craig

"Thanks for the toys, Dad!"—Just when you thought these Smoke Ridge ranchers were just serious goat ranchers!

**"We're on our way to Kentucky!--
What do you mean we can't *all* go?"**

Partial Herd for Sale

October Farm II, Dick & Dottie Gould
Rt. 1, Box 63 Baker City, Oregon
phone: 541-523-9859, fax: 541-523-9436
email: octfarm2@eoni.com

Due to our move to Kentucky (in one month!)
We must sell most of our herd.

Good, healthy stock, excellent records!

For Sale:

6 bucks* -- $100@
6 '97 wethers -- $75@
18 '98 wethers -- $65@
6 '97 does (never bred) -- $110@
8 '98 does -- $100@
16 2-6 yr does (not bred this year yet) -- $175@

10% discount on 5 or more animals
15% discount for entire herd, OBO

Variey of Colors

Variety of lines--Austran Captain, Genghis Khan, LCC Merlin, Arboretum Farms, Karakan, Cascho Alchemist, Cashco Envoy

***Bucks:** **#4g** - 3 yr, white, by LCC Merlin/Captain daughter, tested '97-450g, 16.4μ, 30.65% , '98-16.7μ,
#28y - 3 yr, white, Captain son, tested'97-580g, 18.2μ,40.8%, '98-19.8μ
#93p - 2 yr, BR/W, Copper son, tested '97-300g, 15.82μ. 40.8%. '98-16.6μ
#119p - 2 yr, white, grandson of Captain, tested '97- 245g, 15.6μ, 47.92%, '98-17.4μ
#205b - 1 yr, white, by AF, out of Cascho daughter, tested 16.6μ
#207b - 1 yr, white, same as above (brother), tested 15.5μ

Cashmere Shawl Pattern Alert!

I am always on the lookout for good knitting or crocheted patterns for handspun cashmere, especially those which take a minimum of work and skill, but look great when completed. I found one!

In the last issue of *Spin-Off Magazine* (Fall 1998), on page 76, there is a pattern for a Crocheted Shawl by Dorothy Bodman, Wilverhampton, England. The shawl calls for the use of Jacob sheep wool, but it works wonderfully in cashmere.

The pattern calls for the use of finely-spun singles (don't need to ply it). She instructs you to crochet the shawl directly off your bobbin on a lazy kate, which will give you the proper tension for your yarn. It seems to work.

There's only four rows to the pattern after you do your base row to start out and you are to continue the pattern progression until the work is square—which should be about 50" per the pattern. The pattern calls for the use of a US 5 or F crochet hook, which is a fairly tiny thing.

The result is fine and lacy and the pattern is not difficult. I started my shawl in white cashmere from my goats (commercially dehaired) the day I received the magazine. The singles had been spun fairly fine. I have read somewhere that hand-spun yarn which is to be crocheted should be twisted in the opposite direction than if the yarn is to be knitted—something about the process of crochet will untwist the yarn if you don't. My singles were spun normally and seem to work fine.

The pattern also can be modified easily to make a scarf, which is what mine will be. I crocheted on the pattern for about 8", debating whether I needed to go back and start over because I had made the initial chain too tight. I had originally intended to make the whole thing—the entire 50" shawl. However, if when blocking my work after completion, the end was still too firm, I knew I would be really upset after all that work. So I stopped at 8" and single-crocheted a couple of rows around the edges to even things up. I now have a gorgeous 8" X 50" scarf which I will block and fringe. It took one ounce of cashmere.

And now that I know, I will start over on the shawl, being very careful to chain on very loosely. From the weight of the finished scarf, I estimate that a completed shawl, at the weight I spin my singles, would take about 6 ounces of fiber.

I recommend this pattern for a quick crochet scarf or for a very nice (easy) shawl. This pattern would be excellent for a crochet beginner. Only thing that makes it difficult is that the work is tiny and is hard on the eyes after a while. Not something you want to work on for days at a time.

Some Brief Comments on Line Breeding

Barrie Restall, Capratech Consulting

September 1998©

Line breeding is an animal breeding practice that has been used for a long time. It is aimed at maintaining a direct relationship to a chosen ancestor, presumably of superior merit to the herd or breed in general.

Breeders practice line breeding because individuals do not live long enough for the breeder to get all the sons and daughters they want from the chosen one; they also know that an individual's influence can be diluted in 3 or 4 generations by mating with unrelated individuals. I suppose you could say that these breeders see line breeding as a "ratchet mechanism" to hold gains while making further progress. While this might seem like a good idea, it would only be sensible if the selected ancestor was outstandingly superior to the breed in general, and this is rarely the case.

In the genetic terms, Line Breeding is the name given to mating schemes that aim to have one ancestor appear frequently in one pedigree. This means that the individual has a high proportion of its genes in common with the ancestor. In effect the result of line breeding is to almost reproduce the entire set of genes of that particular ancestor. If the ancestor was famous or very good this may seem sensible, but it is equivalent to admitting that there has been no improvement in the herd since that ancestor was born.

In my experience, there are practically no herds with such outstanding animals as to merit some form of limited line breeding combined with some other selection scheme. Usually the worth of a sire is not known until his progeny are measured, and there are usually several animals of apparent equal merit in any particular drop, so the choice of who to line breed to is very risky. The dangers of line breeding include inadvertently selecting less than the best sire to line breed and thus discarding other possible superior genotypes, and/or selecting a sire with undesirable
characteristics that show up later in the progeny. And finally line breeding, like inbreeding, reduces the genetic variation in the herd and reduces the chances of breeding animals of superior merit.

In essence then, Line Breeding resurrects the past and does not have much to do with breeding better animals for the future, and is not a progressive form of breeding. The modern animal breeder has better tools available for improving herd performance.

Breeding Schemes

Roll the Dice? Stack the Deck?

By Linda Fox

Inbreeding, Linebreeding and Two-Headed Goats

I read an interesting article in the September 1998 *Meat Goat News*. The article was entitled "Linebreeding vs. Inbreeding," written by Fred C. Homeyer from San Angelo, Texas. He was explaining the difference between the two terms and the advantages and disadvantages of linebreeding.

The article caught my eye because, like most small breeders, we wonder exactly when we should stop using that great buck we already own and shop around for "outside blood." We worry about getting to the point where our inbreeding/linebreeding creates the perfect cashmere goat—perfect, except for that one small problem—the goat has two heads.

We've always wondered how close of a breeding is "too close." Mr. Homeyer defines linebreeding as the breeding of two animals who are related in an attempt to intensify the characteristics of a certain ancestor within the herd. He explains that "Linebreeding is the most powerful method known of making the most of the excellence of superior individuals." Linebreeding will not create excellence, but will merely emphasize the characteristics of a certain individual—that great buck, for example. Unfortunately, he explains, it will emphasize the bad characteristics along with the good. Linebreeding does not create a bad characteristic, just as it does not create excellence, but it will load up the genetics on the bad traits, along with the good and possibly cause some of the bad recessive traits (which are carried genetically in that superior individual, but do not physically show up in the animal) to show up visually in the progeny.

This article indicates that you could continue to breed a buck to his daughters and again to their daughters, and again to their daughters...as long as the buck remains in service. And, when the buck is no longer in service, you could then begin to use that buck's progeny to continue the "loading up" of desirable genetic traits within your herd.

Per Mr. Homeyer, "Probably no one thing has been more disastrous to many herds than the superstition of needing 'new blood,' and the fear of close breeding." He goes on to say that the dangers of the closest breeding possible in your herd carries fewer dangers than the dangers of introducing undesirable characters into your herd with "new blood."

Of course, bringing in an outside buck to bring desired characteristics to your herd is not breeding for "new blood." Bringing in "new blood" would be when you have a perfectly good buck in your herd for the characteristics you want in your line, but you don't want to use him because he is too closely related to the does who need to be bred.

However, this article is not about linebreeding/inbreeding, it is about the breeding information I ran across while searching other sources for opinions to the question: "How close a breeding is too close." (I never did find additional opinions on this question. I did, however, put the *CashMirror* Ace Reporter on the question, who will, hopefully, give you more information in a future issue.)

Other Interesting Breeding Tips/Information

Progeny Testing for an Unproven Buck

An unproven buck is defined as a buck who, even though he has great characteristics himself and looks like he would be a great breeding buck, has not yet been used for breeding so you do not know if these great characteristics will be passed on to his progeny. An unproven buck, if not used yet for breeding, may not even be fertile. It has been found that an average of 5% of bucks are infertile for a multitude of reasons.

Some breeders progeny test all bucks before they use them extensively in their herd. For progeny testing, they put the young buck (wearing a high-fashion breeding harness) in with 150 does for a few days. Usually 10-15 does will be bred during this time; you will

Continued on next page

Breeding Schemes

Continued from previous page

know which ones have been bred because they will have been marked with the buck's harness. The bred does and the young buck are separated from the herd and allowed to remain together for the rest of that day. Then, the does are removed. After a week, these same does are run with a proven "backup" buck just in case they were not bred by the young buck. The rancher will know by which buck the doe has been bred by when she kids.

Characteristics of the progeny from the mating with the unproven buck are analyzed to give an indication of the buck's genetic breeding value. Weaner-aged bucks are generally the ones tested in this manner, but 18-month bucks are sometimes tested this way as well. At this age, they have already been culled after the testing of their first fleece and the progeny test becomes a later culling test.

Effective Population Size

A population size (goat herd size) of less than 10 individuals is unlikely to contain enough animals for inbreeding to make genetic gains. A population (herd) of 100 animals would be more than satisfactory in most cases. Comprehensive records and great attention to detail would allow smaller populations to be used. In order for producers with small populations to make genetic improvement, they must regularly bring in outside bloodlines.

Selecting for Multiple Traits/Related Traits

When selecting breeding stock/groups to improve or pass on desirable traits, there are normally multiple traits to be considered, including down diameter, down length, body size, down weight and body conformation. Often selection for one desirable trait will negatively affect another desirable trait. For example, selecting only for fine down, has a negative effect on down weight. If your only selection criteria is fineness of down, you might end up, after many generations, with a herd of goats producing 10 grams of very fine cashmere out of which you can make two, maybe three fingers of a glove.

And, of course, the reverse of the above—if you select only for increased down weight, you will eventually get a whole lot of something outside of the cashmere diameter range growing on your herd. Whatever you want to call it (knowing if you continue to call it cashmere after it bumps out of the 18-19 micron range, you will have the cashmere police knocking at your door), you will have a lot of it.

Two other logically-related selection traits are cashmere weight and down length. Longer cashmere weighs more than short cashmere. Cashmere length can be used to estimate down weight. There is a strong relationship between down weight and down length. Length can be an indirect measurement for down weight for culling purposes. It is quicker, cheaper and easier to measure length of cashmere than down weight

Two traits which are less-obviously related, are down weight and body weight. Selecting for increased down weight tends to reduce the body weight of the animal. By selecting only for down weight, you will select for smaller goats. As the goat herd becomes smaller and smaller and the fleeces become heavier and heavier, pretty soon you have a herd of tiny goats smothering in their own huge fleeces. Smaller body size would also decrease the value of cull and excess goats on the meat market.

For selecting for multiple traits, you may use a "selection index," a useful mathematical means of weighting each trait to enable each animal to be given an "index value" in order to rank them in value within the herd. After all animals have been ranked with the selection index, animals under a cutoff level would be culled. The index value might also be used as a selection tool for superior breeding animals.

Inbreeding/Linebreeding Definitions:

Inbreeding—breeding of two related individuals. Inbreeding reduces the genetic variation within the herd. It can concentrate the genetic characteristics for which you are selecting. It also produces what one author calls, "inbreeding depression," which is the opposite of "hybrid vigor." Inbreeding depression is defined as a depression of characteristics such as reproduction, growth rate, fleece weight, etc.

Linebreeding—A less intensive form of inbreeding. Individuals with different bloodlines, but who are still related to a particular superior individual, are continually introduced in hopes increasing the occurrence of the superior animals' characteristics within the herd while avoiding that annoying "inbreeding depression."

Cross breeding—Hybrid Vigor

Crossbreeding is defined as the mating of individuals from different breeds or strains. (See photograph on next page.) This often produces progeny whose performance is better than either of the parents. Hybrid vigor is a reversal of the dreaded "inbreeding depression" and is more pronounced when the genetic difference of the animals is greater. The traits improved are generally those having to do with viability and reproductive ability and unless continued crossing is

Continued on next page

Breeding Schemes
Continued from previous page

practiced, these great effects rapidly disappear in succeeding generations.

Generation Interval
This is the length of time for a succeeding generation to replace its parents. The shorter the generation interval, the less time it will take for genetic improvement in a herd. If the parents are kept and used after producing and raising offspring, the generation interval is extended. It would seem that for quickest genetic improvement, a breeder would want to breed first year doelings to young bucklings and dispose of their parents each year. Unfortunately, at this time, it is difficult (if not impossible) to select the best breeding stock from the young animals. Also, with the current state of cashmere genetics, many of the parents will be better than the worst of the offspring. If parents are kept for future breeding, the generation interval is extended. There are formulas for computing the generation interval when parent stock is maintained, but we won't visit them here.

Use of Young Bucks
Even though bucks can usually breed as early as six months of age, it is unwise to overwork a young buck; it may stunt his growth. A yearling bucks can be used extensively, especially if you remove him from the doe herd (Good luck with this!) at night, pen him and feed him. He can be put back with his girls the following morning.

A yearling or older buck can successfully breed 50 or more does, but it would be better if the buck was not exposed to all the does at the same time. This is especially true if the does cycles are somewhat synchronized.

Timing of Kidding

An example of cross-breeding? A Rocky Mountain Bighorn Sheep (ram) has found a herd of cashmere does. Think of the hybrid vigor! Fortunately, the ram was not interested in these cashmere does. Unfortunately, he was interested in the domestic sheep. Photograph by Steve Hachenberger, Castle Crags Ranch, Montana.

Kidding late in the cashmere growing season may cause premature shedding and loss of fiber. Lactation also provides competition to cashmere growth. If maximum cashmere production is the primary goal, kidding should be planned so that late gestation and lactation are out of the cashmere growing season as much as possible. Once a year kidding, as opposed to kidding more than once per year, would also be desirable where cashmere production is the number one goal.

Heritabilities
So, you've always wanted to know what to do with those heritability numbers you see around? You find them fascinating and you understand the general concept, but you'd really like to crunch a few numbers and see how they relate to your herd? This is assuming, of course, that your herd is big, that you don't inbreed/linebreed and that your herd is similar to the research herd/s in which the heritability figures were derived. Read on.

Heritabilities, like most statistical figures, are based on numbers—a lot of numbers. Heritabilities are derived from the study of large populations and the numbers derived will be most accurate when used to predict the outcome of a large group which is similar to the group studied. To take heritability numbers and use them to compute the likely outcome of a mating between two goats in a small herd, will probably not be accurate. But, hey, we're going to do it anyway.

Heritability is a proportion—a value between 0 and 1 which indicates how likely a trait will be passed from the parents to their offspring. As the heritability proportion closes in on 1, the more likely the desired characteristic will appear in the offspring. Heritabilities for production characteristics are considered high if they are above 0.4, moderate between 0.2 and 0.4, low if less than 0.2. Heritabilities rarely exceed 0.6 for production characteristics. Heritabilities for reproduction and survival characters are usually low.

Continued on next page

Breeding Schemes
Continued from previous page

A breeder can increase the chance of characteristics being inherited by avoiding the mating of related individuals. In a small herd, if related individuals are mated (linebreeding/inbreeding), the genes become "fixed" and heritability of characters is reduced.

The raw heritability figures indicate the extent to which characteristics can be passed to offspring. Heritabilities for selected characteristics are as follows:[1]

Characteristic	Heritability
Body weight	.29
Fleece weight	.29
Yield	.90
Down weight	.61
Down diameter	.47
Down length	.70

However, actual changes to the genetic make-up of the herd are affected by the amount of selection pressure applied.

Selection Pressure
The amount of selection pressure applied relates to how much the characteristics of the individuals selected for breeding exceed the average characteristics of the herd. If a buck to be mated to a group of does within your herd has a fiber diameter which is 3 microns less than the average of the herd, using him will provide more selection pressure than using a buck whose fiber diameter is only 2 microns less than the average of the herd. The more the selected breeding stock's characteristics differ from the average of the herd, the more "selection pressure" is being applied to the heritability figure.

Ready for another big word?

Selection Differential
Selection differential is how much a superior animal deviates from the herd average. In other words, if the average cashmere diameter of your herd is 18 microns and the cashmere diameter of Mr. Super Buck is 15 microns, SB's selection differential is -3 (15-18=-3). But, as we all know, SB is only half of the equation. Ms. Good Doe has a selection differential as well. We'll assume Ms. GD's selection differential is -2—her cashmere diameter is 16 microns (16-18=-2). In order to compute the average selection differential, we average SB's and GD's individual selections differential numbers: -3+-2 / 2 = -2.5. The "mid-parent" selection differential is -2.5. Remember this number. We will use it in combination with the heritability numbers above to predict what SB and GD will pass on to their little kids (LK's).

Now what?

Response to Selection
This is it—what we were trying to get to. The response to selection is the amount by which one generation of offspring exceed the average of the herd, in the characteristic for which we are selecting. You can calculate the predicted response by multiplying the estimated heritability by the average parental selection differential. This number added to the average of the herd, is the expected value to be seen in the progeny for the selected characteristic. For example, using our figures from above, the selection differential for SB and GD is -2.5. We would multiply this by the heritability for down diameter, which is .47. (-2.5 X .47 = -1.18) The product is -1.18. This is the estimated response to selection. We would expect the cashmere diameter of the kids of SB and GD, to be 1.18 microns under the herd average. The herd average for cashmere diameter is 18 microns, so we would expect the kids to bear 16.82 micron fleeces (18.00 - 1.18 = 16.82).

Just in case you made it through this example, remember that this example is very simplified and actual numbers obtained from a real test would most likely be different.

Drs. Restall and Pattie presented a paper at the 1996 Cashmere Wyoming conference which presented the results of a six-year study on cashmere goats, where they compared estimated heritabilities (obtained from their previous research during 1980 - 1985) with realized heritabilities in their six-year study conducted from 1985 to 1990. They were able to confirm that the realized heritabilities fell within the standard error allowance of their estimated heritabilities, thus verifying that the estimated heritability figures as a useful tool in genetic selection. This study was conducted using 680 breeding females and 330 males.

References:
Homeyer, Fred C., Linebreeding vs. Inbreeding, *Meat Goat News*, September 1998, page 14.
Cashmere Goat Notes, Australia (1990):
Vickers, Ron & Bess, Thompson Bros. and Levinge, Richard and Browne, Sheba and Moxham, Rod and Squire-Wilson, Leal & Kissel, Robin, *Selection of Sires*, 129-130.
Browne, Jim, *The Fundamentals of Animals Breeding*, 121-124.
Pattie, W. A., **Breeding Cashmere in Australian Goats**, 137-141.

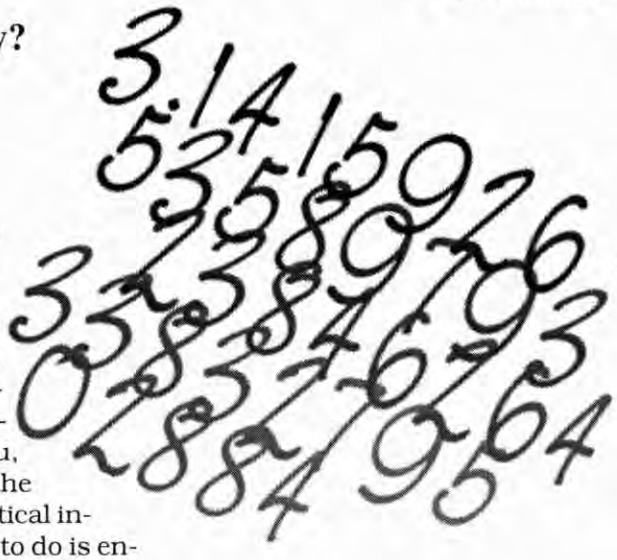
CaPrA Goat Tips:
Ross, Connie and Hale, Jim, *Introduction to Management*
Shelton, Maurice, *Management of Reproduction in the Goat*

[1]Restall, B. J. and W. A. Pattie, 1991, Breeding Cashmere Goats.

Pattie, W. A. and Restall, B. J., 1996, *Selection Responses in Cashmere Goats, Results from the Wollongbar Selection Lines*, Proceedings of the 6th Annual Cashmere Producers of America Conference Breeding Track, 47-64.

The Superior Animals—How Good Are They? (Statistically Speaking)

By Linda Fox



Statistics is an tool. From a set of data, you can calculate a bunch of other useful numbers. You measure an important characteristic on a few goats (much more useful if you measure a lot of goats) and then, after crunching these numbers, you can create useful facts for analyzing individuals within your herd or for comparing animals outside of your herd to see how they stack up to your herd.

Anyone seriously into cashmere goats should have a data base for their herd. This data base can be on paper or it could be on a computer. Computer records are preferable as it is much easier to crunch numbers from a computer data base than from paper records. Paper records and a small statistical calculator will do the job, however, but a computer makes the job more pleasant.

Herd Average (Mean)

From your records, which include measurements on your herd for the characteristics which you consider important, you can compute the herd average for each characteristic. With the average in hand, you can consider each goat in the herd in the terms of, "Is this goat better or worse than my herd average." Or, "Is this goat better or worse than the average of the herd down the road?"

Standard Deviation

Another useful statistical number is the standard deviation. This number tells you how far from the average a particular animal is, in a form that can be more easily compared to a standard population. The formula for computing the standard deviation is long and complicated. I won't give you the formula here—if you don't already have it, you probably don't want it. Besides, an inexpensive statistical calculator will compute this number for you, as well as computing the average and other statistical information. All you need to do is enter the data for the characteristic being studied. The standard deviation will be larger in a herd as the variability increases. A herd of 10 goats who all have fiber diameters within the 15-16 range will have a smaller standard deviation than a herd of 10 goats with fiber diameters in the 14-17 range.

To say a particular animal's fiber diameter is 2 microns below your herd average sounds good, but how good is it? If that animal's fiber diameter is 2 standard deviations better than the herd average, this is much better than if the goat's fiber is only 1 standard deviation better than the herd. Depending on the herd—the number in the herd and the variability within the herd—2 microns could be any number of standard deviations.

Characteristics for large populations and an individual animal's place within the population, once put into mathematical terms, acts very predictably. The characteristics will group around the average for the population in a predictable manner. More goats will be closer to the average—just under or just over—than those whose measurement will be further from the average. The further from the herd average you go, either above or below, the less goats you will find there. In other words, there will be more goats who are closer to average herd characteristics than there will be extremely poor goats or extremely good goats. Keep in mind that when we're talking "good" or "bad" here, we're just homing in on one characteristic on the goat.

Statistics for different populations follow the same patterns and by using standard deviation units, we can estimate the limits and means of any part of a population. We know that 50% of the herd will have characteristics greater than the average and 50% will have characteristics lesser than the herd average. Statistically, we know that the average of the top half of the herd is .8 standard deviation units greater than the average of the herd as a whole. We also know that 16% of the population will exceed the average by one standard deviation and that of this top 16%, their average will be 1.52 standard deviation units better than the average for the entire herd.

An example illustrating the concepts in the above paragraph, using a herd of 10 goats and analyzing for weight of cashmere down (fleece without the guard hair) is as follows:

Continued on next page

Superior Animals

Continued from previous page

I have 10 (pretend) goats whose cashmere down weights (in grams) are as follows:

Animal No.	Down weight
1	100
2	200
3	120
4	150
5	130
6	80
7	150
8	180
9	210
10	200

Average cashmere down weight for this population is: 152 grams

Standard deviation for this population is: 45 grams

I'm not going to show you the math here. You'll have to trust me—I have an inexpensive statistical calculator!

From the animal list above, our "best" animal is number 9, with a down weight of 210. How good is she in relation to the rest of our herd? Her down weight of 210 is 58 grams above the average for the herd. If we divide this 58 grams of extra fleece by the 45 gram standard deviation for the herd, we get 1.29 (58/45=1.29). This animal's fleece weight exceeds the herd average by 1.29 standard deviations. Just how good is this?

Fortunately, there is a table with which we can compare our goat to determine how excited we should be about this 1.29 standard deviation. This table—entitled Table of Standardized Selection Differentials—is printed at the right.

How to Use This Table

This table illustrates, using standard deviations, the number of individuals within the population likely to be found within each standard deviation. For example, if you have a herd of 50 goats, you would expect that 2% of them (1 goat) would have a down weight 2.25 standard deviations above the herd average and we would expect that if we selected 40% of the "best" individuals (20 goats), their down weights would average .95 standard deviations above the average for the herd. You can see from the table that as the population size grows, you have a better chance of having an individual who exceeds the herd average by a greater number of standard deviations.

In our story problem above, we have a herd of 10 goats and have selected one goat to compare with the herd. We (all on our own) compute that one goat out of a herd of 10 is a 10% selection. In the table, we read that in selection the top 10% from a population of 10, we would expect our selection to be within 1.54 standard deviations of the population mean. Our prize goat's down weight is merely 1.29 standard deviations from the herd mean. (Sigh.)

Remember that our example uses a small number of animals. Statistics is a more useful tool when applied to larger numbers. A population of 10 is a small population; a population of 100 is generally considered an adequate-sized population for statistics to provide reliable estimates for useful application.

Just for fun, let's expand our story problem to include a herd of 100 goats. Since I don't want to punch in 100 numbers into my cheap little calculator, I will cheat somewhat and make up my pretend herd so the results will be easier to calculate using the tools as hand. If I wanted to break out the "big guns" (aka the computer) I could pretend anything I wanted without much difficulty, but let's be humble here.

I have a (pretend) herd of 100 goats. Fortunately for me, I have 10 goats each whose down weighs the same

Continued on the next page

Table of Standardized Selection Differentials

% of Population	Size of Population 10	50	100	200	Large
.5	-	-	-	2.75	2.89
1	-	-	2.51	2.58	2.67
2	-	2.25	2.33	2.37	2.42
3	-	2.15	2.20	2.23	2.27
4	-	2.05	2.10	2.13	2.15
5	-	1.91	2.02	2.04	2.06
10	1.54	1.70	1.73	1.74	1.75
20	1.27	1.37	1.39	1.39	1.40
30	1.07	1.14	1.15	1.15	1.16
40	0.89	0.95	0.96	0.96	0.97
50	0.74	0.79	0.79	0.79	0.80
60	0.60	0.63	0.63	0.64	0.64
70	0.48	0.49	0.49	0.50	0.50
80	0.32	0.34	0.35	0.35	0.35
90	0.17	0.19	0.19	0.19	0.19
100	0	0	0	0	0

Superior Animals
Continued from previous page

as each individual goat in the previous 10-goat example. Therefore, I have the following herd for my population:

Animal Nos.	Down Weight
1-10	100
11-20	200
21-30	120
31-40	150
41-50	130
51-60	80
61-70	150
71-80	180
81-90	210
91-100	200

I have a total of 100 animals.

Average down weight for this population is: 152 grams

Standard deviation for this population is: 43 grams

So, how good are our 10 goats with the 210 grams of down? They each have 58 grams of down weight above our herd average. Their down weight exceeds our herd average down weight by 1.35 standard deviations (58/43=1.35). From our Chart of Standardized Selection Differentials, on the previous page, we find that in a herd of 100 goats, we would expect the top 10% of our goats to exceed our herd average by 1.73 standard deviations which, in terms of down weight, would be 74 grams (1.73 X 43=74). Our great top 10 only have 58 grams of extra down per goat. (Sigh) These 10 goats are not looking as good to us in a larger herd, where estimates based on statistics tend to run closer to reality.

However, remember that we are just pretending here for the purposes of gaining a better understanding of how you can use mathematics to help analyze an individual within your herd in comparison to your entire herd.

Publisher-Mandated Apology

I, as the author of the previous story about superior animals, deeply regret any misunderstanding I might have caused by pretending to have a whole herd of cashmere goats with 200 grams (and more) of down each. However, I want you to know that I wasn't technically incorrect as I was only talking about grams and everybody in the US knows that only things stated in ounces really count. However, even though not technically incorrect, the Publisher thinks I should apologize so—I take sole responsibility for this illusion. I realize this may have led the new cashmere goat owner to believe that they should immediately sell their half-bald goats on the meat market and shop for furrier stock. I'm not real sorry, however, since as long as I got to pretend, I thought I might as well pretend big. If you need me to pretend I'm real sorry, I will. If you wish to place your vote for me to pretend that I'm real sorry, please call 1-800-sukeggs.

Sustainable Agriculture
What is it?
What's in it for me?

By Paul G. Johnson

Some farmers' eyes glaze over when they see words such as: agroecology, holistic resource allocation, or ecosystem degradation. Then there are those who say it is just common sense. After all, if what you take out of a farm is more than you put back, you ain't agoin' to be a farmer long. Or at the least you will be paying out more for feed and minerals than you need to. So the answer to " What's in it for me?" is— Money!

Many universities in North America have programs and centers which are more than ready to assist you. A few of these are listed at the end of this article.

A common thread which runs through all sustainable Ag programs is restricting the use of chemicals, such as for weed control. "Ha!" says I, "We goat farmers already solved that one!" "Goats, nature's best herbicide," as Richard and Harriet Jensen's bumper sticker proclaims.

Maintaining a balance in your pastures is a key. You must know when to move animals in or out of a certain pasture so that you are maximizing the natural forage. Leaving goats (or any herbivore) in one field too long allows them to graze the forage too low for it to regrow. For some plants, such as our poison oak, this is great. But, overgrazing will limit the regrowth of other more desirable plants as well.

Understanding the nutrient value of plants is helpful. With just a little care and a pasture rotation system, you can lower your feed bill, and help the ecology of your own,

Continued on next page

Sustainable Ag
Continued from previous page

personal ecosystem. Not to mention having healthier goats in the process. Frequent pasture rotation prevents a pasture from getting abused by the trampling of little (or big) hooves, and allows the spreading of the goats' bodily wastes over a wider area, rather than concentrating it in one place.

In our area, with an overabundance of rain, pastures and paddocks can be quickly chewed up and become a muddy mess devoid of any plant or grass. In dry climates, the impact of overuse of a field is even more extreme, as plants take longer to recover, if they recover at all.

If you can keep the quality of your forage high, by limiting exposure, you will find it assists in goat health in stressful times such as lactation, kidding, breeding, etc. There will be less need to supplement with expensive hay and/or grain.

I have personally seen areas of SE Oregon and the desert Southwest where over-grazing has left a desolate landscape that will take several human generations to recover. Land is too valuable to waste when just a little care can earn big rewards.

Stated goals of some of the Sustainable Ag Centers are:

University of Guelph, Ontario, Canada
"The broad goal of the farming systems research venture is to develop and test an approach for assessing the health and sustainability of Ontario's farming systems. The project seeks to define and understand interactions between environmental, economic, and social phenomena at the spatial scale which is most relevant to decision making and resource management - the farm. Thus an important objective of the project is to provide applied research and practical information in a form that is of direct benefit to producers and agricultural advisors."

University of Nebraska
" ...for the purpose of bringing together people and resources to promote an agriculture that is efficient, profitable, environmentally and socially sustainable for the indefinite future."

University of Maine
"Many factors have convinced the agriculture community to seek new approaches to theproduction of food and fiber. Among these factors are increasing input costs, pesticide resistance, ground water contamination, soil erosion, decreasing soil fertility, and the demand for chemical free food."

Washington State University
"To develop and foster agriculture and natural resource management approaches that are economically viable, environmentally sound, and socially acceptable."

These, and many other schools and extension offices offer advice on:

Ways to increase farm profits by decreasing the costs of livestock production;
Ways to build up your pastures through rotation, multiple cropping, and nutrient cycling;
How to protect water quality by decreasing the need to use synthetic agrichemicals;
Ways to manage livestock diseases with integrated, ecologically sound strategies;
How to compromise between quality of browse and yield of browse.

Check out sustainable agriculture programs with your local extension office. They will be glad to help. Also, ATTRA, whose address is listed below is a great resource.

ATTRA - Appropriate Technology Transfer for Rural Areas
Http://www.attra.org/
PO Box 3657
Fayetteville, AR 72702

University of Nebraska, Lincoln, NE
http://ianrwww.unl.edu/ianr/csas/

University of Guelph, Guelph, Ontario
http://www.oac.uoguelph.ca/www/FSR/

University of North Carolina - Chapel Hill
http://sunsite.unc.edu/farming-connection/links/univprog.htm
This site is a place to find links to various sustainable agricultural sites.

University Sustainable Ag Programs
http://sunsite.unc.edu/farming-connection/links/univprog.htm

Sustainable Agriculture at The University of Maine
http://kramer.ume.maine.edu/~aes/Undergrad/Sust-Ag/sustain.htm

Center for Sustaining Agriculture and Natural Resources, Washington State University
http://csanr.wsu.edu/

Recent Advances in Mineral Nutrition of Goats

By George F. W. Haenlein
Cooperative Extension Dairy Specialist
University of Delaware

ABSTRACT

During the last five years major advances in research of macro- and microelement nutrition of goats have occurred. The uniqueness of goats in many aspects of mineral metabolism, especially Cu, I, Se, Mo, as has been documented. Nutritional requirements of Ca, P, Mg, Na, K, I, F, S, Zn, Mn, Cu, Fe, Cd, As, Se, Li, Co, Mo, Pb, Cr, Ni, V, Al, and Br from research with goats are discussed. Mineral deficiencies in goats in many countries are caused by low or variable contents due to season and maturity of plants and low digestibilities. The reliability of body tissues as an indicator of deficiencies varies greatly with mineral elements. Major performance improvements have been achieved, nevertheless, where mineral supplementations were applied correctly.

INTRODUCTION

Required macroelements in feeding rations for goats are: Ca, P, Mg, Na, K, Cl, S. In smaller amounts required are microelements: Fe, I, Cu, Mn, Zn, Co, Mo, Se, F, Cr; to which have been added in recent years: Si, Sn, V, Ni, As, Cd, Li, Br, Pb (Lamand, 1981; Anke and Szentmihalyi, 1986; Haenlein, 1987; Kessler, 1991). Requirements of macro- and microelements, or minerals for short, are based on evidence of metabolic functions, which are structural and/or catalytic.

Minerals activate enzymes, are essential co-factors of metabolic reactions, function as carriers of proteins, regulate digestion, respiration, water balance, muscle reaction, nerve transmission, skeletal strength, pH balance, even mental balance, protect against diseases, are antagonists or synergists of other elements and play a vital role in resistance, adaptation and evolution of new breeds and strains.

Levels of requirements as well as thresholds of deficiency and toxicity vary with age, sex, production level, activity level, species and genetic strain of the animal. This discussion focuses on goats, since it must be recognized that mineral requirements are to a large extent species and breed specific and can only be extrapolated from research with other species and breeds within limits or in a general way.

Significant species differences have been reported for Cu, I, Mo, As, among other elements (Bell, 1959; Haenlein, 1980a, 1991a; Anke and Szentmihalyi, 1986; Devendra, 1989). In case of Mo, goats will tolerate more than 300 mg Mo/kg DM in feed intake, while sheep tolerate only 30 mg/kg DM and cattle will already suffer from diarrhea at 10 mg Mo/kg DM (Falke and Anke, 1987). In case of Cu, toxicity symptoms are noted in sheep at 10-20 mg Cu/kg DM feed intake, while cattle tolerate up to 100 mg Cu/kg DM. Data are still needed but observations have indicated, that goats are tolerant of much higher Cu levels than sheep (Anke and Szentmihalyi, 1986; Zervas et al., 1989). In case of I, radioactively marked I showed that goats transfer 22 percent of diet I into milk vs. 8 percent in cows (Groppel et al. 1988). Colostrum from normal goats also had much higher I contents (3662 nmol/l) than from normal cows (416 nmol/l). Thyroids from goats were lighter than from sheep on equal feed supplies of I, which may indicate that more I is available in sheep for synthesis of T4/T3, and that goats are more sensitive to low I supplies (Groppel et al. 1989). Contents of less than 300 mcg I/kg DM white hair are indicative of insufficient I supplies for growing, pregnant and lactating Swiss goats, while for sheep the limit is 200 mcg I/kg DM white wool. Goat kids with less than 0.6 mg I/kg white hair, but calves with less than 1.8 mg I/kg black hair during week one have probably an I deficiency (Groppel et al. 1988).

Table of Minerals (Alphabetical by Symbol)

Symbol	Mineral
Al	Aluminum
As	Arsenic
Br	Bromine
Ca	Calcium
Cd	Cadmium
Co	Cobalt
Cr	Chromium
Cu	Copper
Fe	Iron
F	Fluorine
I	Iodine
K	Postassium
Li	Lithium
Mo	Molybdenum
Mg	Magnesium
Mk	Mickeyium
Mn	Manganese
Na	Sodium
Ni	Nickel
P	Phosphorus
Pb	Lead
V	Vanadium
S	Sulfur
Se	Selenium
Si	Silicon
Sn	Tin
Zn	Zinc

Supplies of minerals are influenced by climate and soil on which feed plants grew, also by stage of maturity of the plants and its parts (Fiedler and Heinze, 1985; Szentmihalyi

Continued on next page

Minerals

Continued from previous page

et al. 1985; Kalac, 1986). Cu contents in red clover have been reported to decrease from 13 to 8 mg/kg DM, in fescue grass from 11 to 6, in forage rye from 9 to 3, when sampled on April 30 vs. June 11 (Anke and Szentmihalyi, 1986). There are also many mineral interactions in the feed ration influencing net absorption (Haenlein, 1987). Mineral ions compete for anionic ligands to form insoluble precipitates, mineral ions compete for transport proteins, competing mineral ions block enzyme reactions, vitamins affect mineral absorption, fiber in the ration depresses mineral absorption, chelation between amino acids influences mineral absorption, antimetabolites in the G-I tract play a role, mineral absorption availability varies with the physical and chemical configuration of the mineral source, forage to grain ratios, water contents in the feed, acid-base balance, and feed additives all influence mineral gross and net absorption, i.e., digestibility minus excretions into the urine, feces and perspiration.

Symptoms of mineral deficiencies can be general, several or very specific. Surveys around the world, have indicated prevalences in certain countries of mineral deficiencies and excesses, which can be helpful in focusing on alleviating programs. Such soil and plant surveys must be related to metabolic uniqueness of different animal species, and it is recognized that animal tissue analyses are more definitive diagnostic tools, although different tissues have different affinities to macro- and microelements, some have none, and therefore have different indicator values.

Mineral contents in feed resources, their strengths and weaknesses are nevertheless important to know, especially for goats, where browse, forbs and weeds, which have not been studied analytically very much, play such a vital feeding role (Devendra, 1990). Mineral supplementation on this basis has yielded improvement in milk production, reproduction, feed intake and reduced heat stress in other species (McDowell et al. 1983; Harris, 1991). It also has been pointed out (Miller, 1983), that even in the best studied species, cattle, there is no academic agreement as to the feeding recommendation levels of minerals, and there is less agreement and knowledge about the other less studied species, such as the goat. Excesses even of macroelements, such as Ca, can have serious consequences, which besides many other better known interferences will reduce clotting ability of blood and cause hemorrhagic conditions (Hall et al. 1991).

Research interest in the role of minerals for the improvement of livestock productivity, especially goats, is growing worldwide. Ramirez et al. (1990, 1991) showed tremendous variations in the amounts of daily voluntary mineral consumption by free-ranging Mexican goats, which differed between certain months by as much as a factor of 5. If voluntary intakes and plant contents varied that widely during the year, it follows that the goats must have had at least subclinical deficiencies in some months, e.g., for Cu, Mn and Zn, and excesses in other months, e.g., for Fe, Mg, K and Na. What needs to be clarified is net absorption, which has been shown in other animal species to vary widely, and thus influence gross amounts required to be fed daily as well as gross plant contents to satisfy daily intake without supplementation. Specific research papers on goats since the last major reviews (NRC, 1981; Kessler, 1981; Lamand, 1981; Haenlein, 1980b, 1987) will be discussed and have been presented in parts (Haenlein, 1991b).

Nutrition of Specific Elements

Calcium. Requirements in 42 male, 7-months old West African dwarf goats (Adeloye and Akinsoyinu, 1984/85), when gaining 100 g/day, were determined to be 380 mg Ca/kg BW/day or 78.3 mg Ca/kg metabolic BW/day for growth, and 127 mg Ca/kg BW/day or 35.0 mg Ca/kg metabolic BW/day for maintenance. Requirements in 18 lactating Beetal goats (Singh and Mudgal, 1987) were 664, 636 and 628 mg Ca/kg metabolic BW/day, when intake of digestible protein was at 125, 100 or 75 percent of requirements in midlactation. Maintenance Ca requirements were 540 mg Ca/kg metabolic BW/day, and 1.16 g Ca/g Ca secreted in the milk. Supplemental Ca decreased plasma Mg concentrations (Hines et al. 1986). Fecal excretion of all minerals was increased in goats given supplemental Ca. Percentage of apparent absorption of Ca, Mg and total minerals was lower in Ca supplemented goats.

Phosphorus. Requirements in 92 growing, pregnant and lactating German Alpine goats (Barhoum et al., 1987) were at least 3.0 g P/kg DM in the ration/day. Deficient supplies of 2.0 g P/kg DM/day (controls 3.4 g P/kg DM of ration/day) reduced pre- and postpartum growth, conception rate, feed consumption, milk yield, with no effects on fat contents while protein contents were increased, as were abortion rate and mortality. Skeletal ash contents, especially of Ca and Mg were reduced, but mineral contents, particularly of Zn, Fe, Cu, Mg and Mn in the aorta and heart muscle were higher (Barhoum, 1989).

Magnesium. Deficiency reduced in vitro wheat straw degradation from normal 10.6, 12.3, 19.6 percent after 6, 12, 24 hr incubation, respectively, to 7.5, 11.2, 17.2 percent in goats and sheep alike, but acetate and propionate contents changed from normal 50.0 percent and 38.5 percent to 55 percent and 32.5 percent, respectively (Flachowsky et al., 1990). Feeding of maize to young goats seemed to prevent a whole-milk induced hypomagnesaemia (Hines et al. 1986), suggesting that Mg in normal goat milk is inadequate to maintain normal plasma Mg levels.

Continued on next page

Minerals

Continued from previous page

Sodium. Ratios of Na:K in saliva of less than 4 were diagnostic of incipient Na deficiency (McSweeney et al., 1988). In Na deficient goats, feed intake was reduced by 6 percent, weight gain by 20 percent, milk yield by 32 percent, while there were no effects on reproductive efficiency, although the sex ratio had changed in kids toward more females (Ivandija, 1987). For normal milk yields, goats should be given 1.74 g Na/kg ration DM/day, while levels of 0.31 g Na/kg DM/day are inadequate.

Potassium. High K levels in water hyacinth (*Eichhornia crassipes*) fed to goats ad libitum resulted in 80 g K/day intake and in death of all goats after 6 to 32 days, with lesions in kidneys, liver and heart (Mishra et al., 1987).

Iodine. Thyroid contents in long-term goat studies correlated highly with contents of I in feeds, hair/wool, milk, serum and all organs tested; hair being a good indicator of long-term I status in goats (Groppel et al. 1988, 1989). Feed and forage analyses showed that unsupplemented rations are probably often I deficient. Rations with marginal contents (0.11 to 0.13 mg I/kg DM) reduced feed intake of goats by 30 percent, and decreased growth, 1st services conception rate, increased abortions, length of gestation, kid mortality, goiter formation and partial hairlessness (Groppel et al. 1986a; b; c; d; 1987; 1990).

Fluorine. Deficiency has been studied in 19 goats over 5 years (Anke and Groppel, 1989). A detailed composition of a semisynthetic diet containing 60 inorganic compounds considered essential is also given with major constituents being 48 percent potato starch, 32 percent beet sugar, 10 percent casein, 3 percent sunflower oil and 3 percent urea. Control goats received 1.5 to 2.5 mg F/kg DM, but the experimental goats less than 0.3 mg F/kg DM feed. Feed intake was increased by 33 percent regardless of growth, lactating, dry or pregnant status. While As, Br, Ni or Cd deficient goats had reduced kid birth weights, many below 1.6 kg, no such effects occurred in F deficiency, although no overweight (more than 4 kg) kids were born either from F deficient does. Nursing kids gained 130 g/day regardless of whether normal or F deficient does were nursing. The semisynthetic ration was biologically fully equivalent to a normal goat ration. However, female kids from F depleted does and depleted during the nursing period gained 24 percent less than the controls. Compared to other mineral deficient goat male kids, Br deficiency or even Al deficiency had more growth retardation than F deficiency. Reproduction of female goats was not affected by F deficiency, although there was indication that with long-term deficiency mortality in kids and does was significantly higher. F deficient goats did not live longer than three years.

Milk yield was not affected by F deficiency in goats (Anke and Groppel, 1989), but they had significantly higher fat and protein contents after 35 days in lactation. F requirements are still unknown, but they are assumed to be 1 to 2 mg F/kg ration DM with a minimum of 1 mg F/kg DM. Only intrauterine depletions lead to growth depressions, which means that the essentiality of F needs further studies.

Sulfur. Studies with 16 mature Australian Cashmere goats indicated that methionine was not a major limiting amino acid affecting cashmere growth, and that the processes of trans-sulphuration in goats may be different from those in sheep (Ash and Norton, 1987). Supplementation with elemental or methionine S (10 g S/kg DM) depressed feed intake and growth in goat bucks (Anke et al. 1987a).

Zinc. Analyses of forage contents showed great variations depending on soils (Szentmihalyi et al. 1985). Red clover and other legumes had more Zn than grasses, and contents decreased with increasing maturity, in alfalfa by 23 percent, in ryegrass by 51 percent. Beet leaves had twice the contents of meadow grass (173 mg Zn vs. 88 mg Zn/kg DM), but grains had much less (Siegert et al 1986). In studies with 8 male, 60-day old goats, Zn secretion was 64 percent in feces and 11 percent in urine relative to intake (Kumar and Kaur, 1987). Daily requirements for growth were calculated to be 0.65 mg Zn/kg BW.

Deficiency of Zn increased Cu contents, especially in the brain, liver and uterus of female and male goats (Gruen et al. 1986). Similar mineral interrelationships were also noted in Cu deficiency, but less pronounced, meaning that Cu absorption increases in Zn deficiency but not vice versa. Other mineral interrelations were observed when feeding bentonite to goats which increased absorption of Fe but decreased that of Cu and Zn (Schwarz and Werner, 1987).

Manganese. In Mn deficient goats the status was identifiable from analyses of hair, kidney, heart, ovaries, pancreas and brain, but not blood plasma (Anke et al. 1988). Hair analyses were reliable when the differential development stages, anagenic, katagenic, telogenic, of hair, its color and type were considered.

Copper. Contents of forages were higher in leaves than stems, and decreased with plant maturity by 40 to 60 percent (Szentmihalyi et al. 1986). Certain browse, twigs and leaf tips of beech trees, pine, beech nuts, blueberry bushes provide increased Cu supplies to wild ruminants (Dittrich and Anke, 1986). Rumen contents from mufflon varied from 6.6 to 12.2 mg Cu/kg DM, and indicator organs also varied widely for Cu, Cd, Zn, Mn, indicating excess or deficiency conditions at certain times. Cu deficiency in goats (less than 2 mg Cu/kg DM/day vs. 8 mg Cu for controls) increased Zn contents in liver and ovaries, and decreased feed intake by 50 percent (Gruen et al. 1986). In Cu load studies, goats

Continued on next page

Minerals

Continued from previous page

consumed more Cu and retained 6 to 9 times less in their livers than their trial lamb mates, indicating differences in utilization and resistance to toxicity between the species, possibly related to soluble hepatic Zn-on-Cu binding proteins (Zervas et al. 1989).

Iron. In studies of Fe, Zn and Cu interrelations in goats and bentonite feeding, high Fe intake led to reduced feed consumption and reduced disease resistance (Schwarz and Werner, 1987).

Cadmium. This is an essential nutrient for goats (Anke et al. 1987b). At less than 15 mcg Cd/kg ration DM plus water over a 10 year period with 79 goats, its deficiency had no significant effects on feed intake but impaired growth, caused myasthenia, reduced milk production, shortened life span and caused unthrifty kids (Anke et al. 1986a). Conditions were corrected with supplementation of 300 mcg Cd/kg DM. Cd deficiency symptoms are not normally expected in Europe, since farm sources test normally above the critical range. Minimum goat requirements for Cd have been set at 50 mcg/kg ration DM (Anke et al. 1987).

Arsenic. Nutrition at less than 35 mcg As/kg ration DM did not reduce feed consumption of 113 goats over a 13 year trial period, but resulted in reduced growth, mainly intrauterine, and after weaning, decreased conception, had less milk production and higher mortality (Anke et al. 1980a; 1987c). Secretion of As in milk of control goats did not differ from levels in milk of deficient goats. A blood-udder barrier exists apparently that is overcome only by high dietary amounts of As. None of the As deficient goats survived into a second lactation. Control kids stored considerably higher amounts of As in their organs than adult control goats, especially in kidneys. Apart from hair, contents of liver, kidneys, testicles reflect As status of adult goats best (Anke et al. 1987c). Contents of less than 10 mcg As/kg DM of liver, kidney or testicles of adult goats indicate deficiency, in kids the limit is about 25 mcg As/kg DM. Minimum As requirements of goats have been calculated to be 50 mcg/kg ration DM/ day, but most feedstuffs and water in Europe are expected to meet this level. Fishmeal can have 2,000 to 19,000 mcg As/kg DM, algae and mussels may be 10 times higher, and water sources can vary tremendously, with some hot springs being especially rich (Anke, 1985; Anke et al. 1986b).

Selenium. Dietary Se is absorbed at a much higher rate than e.g. Fe, Cu, Zn or Mn, and is not dependent on its chemical form of selenate, selenite or selenide (Angelow and Anke 1987a; 1987b). Goats bind Se to casein in their milk and about 3 percent of ingested Se appears in the milk with a correlation coefficient of r = 0.7. Se can be absorbed and is exhaled by the lungs (10 to 50 percent), but most is excreted by the kidneys while fecal excretion is about 10 percent. Se status of goats is best indicated from samples of blood besides milk, muscle, liver, lung and hair, while kidneys and brain reacted the least to Se deficiency (Szilagyi et al. 1986). Se treatment of deficient goats increased serum contents from 32 to 94 mcg Se/kg DM significantly in 4 weeks (Angelow et al. 1986). While milk Se contents decreased in control goats from 512 mcg Se/kg DM to 247 mcg by day 28 of lactation, in Se deficient goats the milk contents changed from 138 to 93 mcg. White hair samples of Se deficient goats tested 183 mcg Se by day 120; 129 mcg Se by day 210; 131 mcg Se by day 300; compared to 353, 333, and 377 mcg Se, respectively for the controls. Kids from Se deficient does had similar low hair contents at birth (Anke, et al. 1987d; e).

Lithium. Recent studies have indicated the essentiality of Li for animals (Anke et al. 1983). Li deficient goats gained less, especially in utero, than controls. Serum was a good indicator of Li status. Serum sorbitol, malate, isocitrate, glutamate dehydrogenases, and activities of aldolases and liver monoamine oxidase were significantly reduced in Li deficient goats (Szilagyi et al. 1989). Reproduction was not affected, but longevity was reduced. Li is not stored in the body in large amounts. Milk and colostrum of deficient goats had much less Li than controls. The Li content of cardiac muscles did not change with deficiency and they appear to have a strong internal control for Li. Different feedstuffs varied greatly in their Li contents.

Cobalt. Long-term supplementation with glass boluses containing soluble Co-Cu-Se compounds prevented Co and vitamin B12 deficiencies in goats (Zervas, 1986; Zervas et al. 1989).

Molybdenum. To use goats as model in studies of mineral metabolism has been proposed recently again (Hines et al. 1986), but as stated earlier that species differences can be considerable, Mo is a good example, where goats are tolerant of high dosages of Mo without showing ill effects in contrast to sheep and cattle (Falke and Anke, 1987). After fertilizing an alfalfa field with 200 kg Mo/ha, the Mo contents of the 1st cutting were increased from 0.88 to 255 mg Mo/kg DM. Feeding the high Mo alfalfa to 5 mature goat bucks increased their organ contents significantly, especially liver, serum, kidneys, but without ill effects over 4 weeks, including normal feces; mufflon on the same diet had, however, severe diarrhea. Increasing the daily Mo intake to 1,000 mg/kg DM produced no toxicity in the goats, but semen quality was decreased.

Deficiency in Mo leads to growth depression, disturbed reproduction and increased mortality (Anke and Risch, 1989). Molybdopterin is the Mo cofactor for xanthine dehydrogenase/oxidase, aldehyde oxidase and sulfite oxidase

Continued on page 26

Calendar of Events

September 26 - 27, 1998
Oregon Flock & Fiber Festival
Clackamas County Fairgrounds, Canby, Oregon
Cashmere, Pygora, Angora livestock and fiber shows and sales. For more info contact Brandy Chastain, 30881 SW Bald Peak Rd., Hillsboro, OR 97123, phone 503-628-1205, email: wstlstop@gte.net
NWCA fleece competition and animal show

September 29 - 30, 1998
ECA cashmere fleece competition,
Virginia State Fair, Richmond, Virginia
For information, contact Ray Repaske, 540-436-3546, cashmere@shentel.net

October 3 - 4, 1998
15th annual Wool Festival at Kit Carson Park, Taos, New Mexico, Demonstrations, sales, animal exhibits. For info contact Nicole Yardley, 6069 WCR 5, Erie, CO 80516, 303-828-3638.

October 7 - 11, 1998
Texas State Fair, Cashmere Show

October 18 - 19, 1998
New York State Sheep & Wool Festival
Rhinebeck, NY. ECA space in Barn 6, Space R with goodies and info, real live goats somewhere on display.

October 23 - 25, 1998
Stitches
Valley Forge Convention Center, PA
Cashmere American Coop will have a booth.

October 23 - 25, 1998
PCMA Business of Cashmere Conference IV
Bozeman, Montana, Holiday Inn Convention Center
For information, Contact PCMA at 406-683-5445, ann@MontanaKnits.com

November 19 - 21, 1998
Ninth Annual TCA Show & Sale & Jr. Meat Goat Show, Brownwood, TX

November 13 - 15, 1998
Kid 'N Ewe (9th annual) Central Texas Wool Market, Blanco County Fairgrounds, Johnson City, Texas. Demonstrations, fiber arts displays, vendors, animals, sheep and goat shearing, lamb dinner with fashion show and auction. For info and tickets: Tara Wheeler (evenings) 512-288-9845, Mary Carol Buchholz (evenings) 512-858-7920.

Association Contacts

American Meat Goat Association
W. E. Banker, President, 512-384-2829

Cashmere America Co-operative
Joe David Ross, Manager, 915-387-6052
fax: 915-387-2642
Wes Ackley (Maine) 207-336-2948
Marti Wall (Washington) 360-424-7935

Cashmere Producers of America (CaPrA)
Marilyn Ackley, President
Phone/fax 207-336-2948
ackley@megalink.net
CaPrA office: 512-452-5205, fax 512-452-5521

Colorado Cashmere and Angora Goat Association (CCAGA)
Carol Kromer, Club Contact, 719-347-2329

Eastern Cashmere Association (ECA)
Ray Repaske, President, 540-436-3546
cashmere@shentel.net

North West Cashmere Association (NWCA)
Pat Almond, President, 503-632-3615
razberi@teleport.com

Professional Cashmere Marketers' Association
(PCMA), Tom and Ann Dooling
406-683-5445
ann@MontanaKnits.com

Pygora Breeders Association (PBA)
Darlene Chambers, President
phone: 541-928-8841, fax: 541-928-0246
email: dchambers@proaxis.com

Texas Cashmere Association
Dee Broyles, President
806-489-7645 office, 806-489-7959 home

Wild Goat Women
Debbie Walstead, Chairperson, 719-495-2962

Breeders

ARIZONA

RANCHO VERDE
Christine Acridge
15419 E Rio Verde Drive
Scottsdale, AZ 85255
602-471-3802

CALIFORNIA

SHERRY MCVICKAR
5160 Hwy. 16
Guinda, CA 95637-9702

SUNRISE CASHMERES
Melody and Jeremy Driscoll
PO Box 245
Blocksburg, CA 95514
707-926-5430

COLORADO

BV CASHMERE GOATS
Bert Appell
29165 Oak Leaf Way
Steamboat Springs, CO 80477
970-879-2160
Fax: 970-879-8701
email: bert@cmn.net

MARSHALL'S MINI-FARM
12906 Appaloosa Ave.
Wellington, CO 80549
970-568-7941

ROLIG GOAT RANCH
Cashmere Producing Goats
Steven or Ellen Rolig
8435 CR 600
Pagosa Springs, CO 81147
970-731-9083, email:
roliggoatranch@pagosasprings.net

KENTUCKY

CANAAN LAND FARM
Theo S. Bee
700 Canaan Land Rd.
Harrodsburg, KY 40330
606-734-3984
1-888-734-3984 (toll free)
http://www.bbonline.com/ky/canaan/

MAINE

BESSEY PLACE CASHMERE
Wes and Marilyn Ackley
RFD #1 Box 2610
Buckfield, ME 04220
207-336-2948
email: ackley@megalink.net

BLACK LOCUST FARM
Yvonne Taylor
PO Box 378
Washington, ME 04574
207-845-2722
email: Lance@airs.com

GRUMBLE GOAT FARM
Linda N. Cortright
574 Davis Rd.
Union, ME 04862
207-785-3350
fax: 207-785-5633
email: grumble@midcoast.com

HARDSCRABBLE FARM
Hattie Clingerman
PO Box 682
Winterport, ME 04496
207-223-4211

MARYLAND

MIDDLETOWN FARM
George and Barbara Little
8123 Old Hagerstown Rd
Middletown, MD 21769
phone & fax: 301-371-8743
email: glittle640@aol.com

MINNESOTA

THE WINTER FARM
Vicki Biggs
122 Caspers Hill Rd.
Grand Marais, MN 55604
218-387-1913
email: momsuper@boreal.org

MONTANA

CASTLE CRAGS RANCH
Diana Hachenberger
894 Pheasant Run
Hamilton, MT 59840
phone & fax: 406-961-3058

SMOKE RIDGE CASHMERE
Craig Tucker / Yvonne Zweede-Tucker
2870 Eighth Lane NW
Choteau, MT 59422
406-466-5952
Fax: 406-466-5951
email: smokeridge@marsweb.com

NEBRASKA

AIRY KNOLL FARMS, INC.
Richard & Harriet Jensen
76460 Road 424
Cozad, NE 69310
308-784-3312

HI-PLAINS CASHMERE
Julie and Alex Becker
160482 County Road C
Mitchell, NE 69357
308-623-2627
email: ajbecker@PrairieWeb.COM

SANDHILLS CASHMERE
Mark and Karen Crouse
Box 595, East Point Drive
Bingham, NE 69335
308-588-6248
fax: 308-588-6236
email: fibergoats@aol.com

NEVADA

ROYAL CASHMERE
Eileen Cornwell
419 Centerville Ln
Gardnerville, NV 89410
702-265-3766
Fax: 702-265-1814
email:cashmere@sierra.net

NEW JERSEY

BLACK FEN FARM
Virginia Hinchman/Kevin Weber
117 RD 2, Rt. 46
Hackettstown, NJ 07840
908-852-7493

NEW MEXICO

DOUBLE EYE FARM, INC.
Sanford Bottino
PO Box 218
Ojo Caliente, NM 87549
505-583-2203

OHIO

TAMARACK RANCH
Bob and Ann Wood
12000 Old Osborne Road
PO Box 567
South Vienna, OH 45369-0567
937-568-4994
email: tamarack@erinet.com

OKLAHOMA

TEXOMA KIDS & CASHMERE
J. D. and Karen Chandler
Rt 1, Box 37
Mannsville, OK 73447
580-371-3167
fax: 580-371-9589
email: jkc@flash.net

OREGON

ABORIGINAL FIBRE
razberi kyan (Pat Almond)
PO Box 899
Mulino, OR 97042-0899
503-632-3615
email:razberi@teleport.com

CASHMERE GROVES
Pat Groves
16925 S. Beckman Rd.
Oregon City, OR 97045
503-631-7806
email: pgroves@europa.com

CHEHALEM CASHMERE
Heidi and Paul Sullivan
21605 McCormick Hill Rd.
Hillsboro, OR 97123
503-538-9791

FOXMOOR FARM
Carol and Carrie Spencer
1178 N.E. Victor Point Road
Silverton, OR 97381
Phone: 503-873-5474
Message: 503-873-5430
email: foxmoorfarm@juno.com

GOAT KNOLL
Paul Johnson/Linda Fox
2280 S. Church Rd.
Dallas, OR 97338
503-623-5194
Fax: 503-624-1704
email: goatknol@teleport.com

HARVEST MOON FARM
Guy and Karen Triplett
63300 Silvis Road
Bend, OR 97701
541-388-8992
email: harvest@empnet.com

Directory

HAWKS MOUNTAIN PYGORA'S
Lisa Roskopf & George DeGeer
51920 SW Dundee Rd.
Gaston, OR 97119
503-985-3331
Fax: 503-985-3321
email:lisa@hmrpygoras.com

HOKULANI FARMS
Cynthia and Karl Heeren
22260 East Highway 20
Bend, OR 97701
541-388-1988
email: hokulani@bendnet.com

K-T CASHMERE GOAT FARM
Kitty and Tom Hanczyk
33758 Totem Pole Rd.
Lebanon, OR 97355
541-258-5857
email: toolguy@dnc.net

MCTIMMONDS VALLEY FARM
Janet and Joe Hanus
11440 Kings Valley Hwy.
Monmouth, OR 97361
503-838-4113
email: janhanus@open.org

MOONSHADOW FARM
Lisa and Jerry Zietz
46080 NW Levi White Rd.
Banks, OR 97106
Voice & fax: 503-324-0910
email: moon@hevanet.com

NORTHWEST CASHMERES
Carole Laughlin
21935 SW Lebeau Rd.
Sherwood, OR 97140
503-625-8816

OCTOBER FARM II
Dick and Dottie Gould
Rt 1, Box 63
Baker City, OR 97814
541-523-9859
Fax: 541-523-9436
email: octfarm2@eoni.com

ROARING CREEK FARMS
Arlen and Cathy Emmert
27652 Fern Ridge Road
Sweet Home, OR 97386
503-367-6698
email:cashmere@proaxis.com

SOMERSET CASHMERE
Julie and Jim Brimble
12377 Blackwell Rd.
Central Point, OR 97502
541-855-7378
email: brimble@cdsnet.net

SUNSET VIEW FARM
Jean Ferguson/Carolyn Bowser
4890 Sunset View Ln. So.
Salem, OR 97302
503-581-9452
email: carolbow@open.org

WILLOW-WITT RANCH
Suzanne Willow and Lanita Witt
658 Shale City Rd.
Ashland, OR 97520
541-890-1998

PENNSYLVANIA

PHEASANT HILL FARM
Ralph, Jan, Ryan & Steven O'Banion
5935 Pidcock Rd.
New Hope, PA 18938
215-598-7627
email: phcashme@voicenet.com

SANDRA ROSE CASHMERES
Jim and Sandra Rebman
RR 2, Box 279
Palmyra, PA 17078
717-964-3052

UTAH

HEIDI'S FARM
Heidi J. Smith
7980 Long Rifle Road
Park City, UT 84060
801-649-3856
email: heidi.smith@genetics.utah.edu

KANARRA KASHMERE
Ron and Jan Gerrity
PO Box 420186
Kanarraville, UT 84742
435-559-9472
fax: 702-242-9436
email: GerrityGroup@EMail.Msn.com

VERMONT

CRR CASHMERE
Tia and Peter Rosengarten
PO Box 37
Weston, VT 05161
802-824-8190
Fax: 802-824-4072

VIRGINIA

FOGGY BOTTOM FARM
Marilee and John Williamson
Rt. 2, Box 223AA
Buchanan, VA 24066
540-254-1628
email: mhwabc@juno.com

RANEY DAY KIDS
Craig and Lucy Raney
3627 Va. Ave.
Goshen, VA 24439
540-997-1121
Fax: 540-997-1124

STONEY CREST FARM
Anne and Roy Repaske
570 Paddy's Cove Lane
Star Tannery, VA 22654
Phone/fax: 540-436-3546
email:cashmere@shentel.net

WASHINGTON

BREEZY MEADOW CASHMERE FARM
Douglas and Roberta Maier
810 Van Wyck Rd.
Bellingham, WA 98226
360-733-6742

BROOKFIELD FARM
Ian Balsillie/Karen Bean
PO Box 443
Maple Falls, WA 98266
360-599-1469 / 360-715-1604

GLACIER VALLEY CASHMERE
Jim and Josie Baine
9817 381st St. E.
Eatonville, WA 98328
360-832-4442

LIBERTY FARM (NLF)
Cliff and Mickey Nielsen
1505 Nile Road
Naches, WA 98937
509-658-2502

STILL WATERS CASHMERE
Moon and Diana Mullins
PO Box 1265
Twisp, WA 98856
509-997-2204/509-421-3107
email: dmullins@methow.com

WALLFLOWER FARM
Dan and Marti Wall
16663 Beaver Marsh Road
Mt. Vernon, WA 98273
360-424-7935
Fax: 360-428-4946
email: cashmere@sos.net

WINDRIDGE FARM
Becki and Jim Belcher
202 Clemans View Rd.
Selah, WA 98942
509-698-3468

CANADA

GIANT STRIDE FARM
Pat Fuhr
RR #3
Onoway, Alberta, Canada, TOE IVO
403-967-4843
email:
giantstride@compuserve.com

MEXICO

EL MORO
Fidel Florez B.
Tecnologico #58 - APDO. #31
Parral, Chih, Mexico 33800
Phone: 3-06-02

Minerals
Continued from page 22

Lead. Contents of Pb were found in the cerebellum, but not in liver, kidney or blood of goats when fed Pb contaminated forages, indicating minuscule amounts of animal tissue retention (Brams et al. 1988). The essentiality of Pb has been established in rats (Kirchgessner and Reichlmayr-Lais, 1986) and studied in sheep (Gruen et al. 1986).

Chromium. Apparently no studies with goats are available so far.

Nickel. Essentiality for goats has been established (Anke et al. 1980b; c). All pregnant and lactating Ni deficient goats had significantly decreased hemoglobin and hematocrit levels. Offspring of Ni deficient goats were born with low Zn contents in their ribs and liver. Parakeratosis-like changes of skin and hair were noted in Ni deficient goats. Milk and muscle analyses did not indicate Ni status, while kidney, brain, liver, heart and ribs did.

Vanadium. Experiments with 37 growing, pregnant and lactating goats over 6 years demonstrated the essentiality of V (Anke et al. 1986c). Deficient goats (less than 10 mcg V/kg ration DM) had deformed tarsal joints and forelegs, reduced 1st service conception rate, 27 percent abortion rate, small litter size, higher kid and doe mortality, reduced feed intake, 10 percent less milk yield, higher blood beta-lipoprotein, higher blood creatinine, less blood glucose, and increased enzymes of the citric acid cycle. Requirements were calculated to be 10 to 25 mcg V/kg ration DM/day.

Aluminum. Although probably not encountered in practical feeding conditions, low Al nutrition (0.2 mg/kg ration DM) in trials over 4 years with growing, pregnant and lactating goats resulted in increased feed consumption and higher milk yield with lower fat contents (Anke et al. 1990). Intrauterine Al poor kids had depressed feed intake after weaning. Reproduction was not affected, but longevity reduced. Ante and post partum Al poor kids had coordination difficulties of the hind limbs, especially on rising and walking.

Bromine. Essentiality of Cl and I is established, of F probable, but more data for Br are still needed (Anke et al. 1989). In 3 long term experiments with growing, pregnant and lactating goats, Br poor nutrition lead to significantly reduced growth, conception, milk and fat yield, lower longevity of does and kids, hemoglobin and hematocrit, and increased abortion rate.

Overall

With this much more goat research data available now, the formulation of mineral requirements is becoming less of an extrapolation of sheep and cattle work (Haenlein, 1987; Kessler, 1991).

References

There are a list of 78 references with this article. They can be obtained from CashMirror, or from the Delaware Cooperative Extension web site at: http://bluehen.ags.udel.edu/deces/goatmgt/gm-03.htm

Classified Advertising

Bucks:
For sale: Yearling Buck. White, very gentle. GS: Austran Captain, GD: CCC Whisper, Champion bloodlines $250 OBO.
For Hire: Yearling Silverbuck. 1st Place Winner '97 Flock & Fiber Festival. GS: Austran Captain, champion bloodlines. Call 503-625-7836, Debbie.

CashMirror back issues 7/96 - 5/98 $3 each or a whole dozen for $20. Back issues 10/89-6/96 $2 each or $15 for a dozen. We'll pay postage just to get them out of our attic. About 2/3 of old issues still available. A good reference source about cashmere goats and history of the industry. Index for 11/89-4/96 in May 1996 issue, index for 7/96-6/97 in July 1997 issue. 7/97-6/98 in July 1998 issue.

CashMirror Calendar annual photo solicitation offer! We're looking for special photographs for the 1999 CashMirror calendar. Deadline for submission is November 1, 1998. For each photo used, you receive one free calendar (and the impress the heck out of other cashmere producers).

Maremma Sheepdog Club of America, Maremma Livestock Guarding dogs, PO Box 546, Lake Odessa, MI 48849, 616-374-7209. Free information and Breeder Directory.

Older women make beautiful mothers—Good-producing four and five year old cashmere does, bred or unbred available now through the fall. Good mothers, several colors. Sim grading, last year's fleeces and past year's kids available for inspection. Goat Knoll, 2280 S Church Rd, Dallas, OR 97338, 503-623-5194, email goatknol@teleport.com

Yocom-McColl Testing Laboratories, Inc. for individual animal and core testing.
Ph: (303) 294-0582
Fax: (303) 295-6944
Email: ymccoll@ix.netcom.com
Website: http://www.ymcoll.com

Display Advertising Rates:

Ad Size	Price (Issue / 4 mos. / 1 yr.)
Business Card	$25 / 100 / 150
1/8 page	$35 / 130 / 320
1/4 page	$45 / 165 / 410
1/3 page	$65 / 240 / 600
Half Page	$80 / 300 / 730
Full Page	$150 / 550 / 1,370
Other sizes, options	Ask us

Extensive layout or photo screening may be extra.
Payment must accompany ad order.

Classified ads 50 cents/word.

CashMirror Subscription Information

To subscribe

Send: Name
Farm Name (if applicable)
Address with zip code

To: CashMirror Publications
2280 S. Church Rd.
Dallas, OR 97338

Annual Subscription is only $25 for 12 monthly issues! ($35 Canada, $50 outside US other than Canada).

Breeders Directory listing for full year $30.

Notable Quotes

"Lack of fact, and ignorance, has rarely deterred the human species from interesting endeavours, and goat breeding is no exception, so let us plunge on."

...B. J. Restall, and W. A. Pattie, Breeding Cashmere Goats, 1991

Kidding in January advances the cessation of down growth, while kidding in June delays the initiation of down growth.

...Annette Litherland, Researcher, E (Kika) de la Garza, 1996

The physician can bury his mistakes, but the architect can only advise his client to plant vines.

...Frank Lloyd Wright

The Deadlines:

Articles, photographs, advertising and other information submitted must be received by the 25th of the month prior to magazine issue date.

If you need assistance designing or laying out a display ad, or fine-tuning an article, earlier is appreciated.

Lisa's ad

Serving northern California, Idaho, Nevada, Oregon, Washington and western Canada

Membership includes: NWCA Quarterly Conferences and optional CaPrA membership

Northwest Cashmere Association

Annual Dues: NWCA only $25 or $50 to include NWCA membership and CaPra (Cashmere Producers of America) Participating Membership and *Concerning Cashmere*
Cynthia Heeren, *Membership Coodinator*, 22260 East Hwy 20, Bend, OR

$3/bar + shipping & handling— Bars are 3+ oz each
Shipping $1.50 for first bar and .25 each additional
13th bar shipped to same address is free!
Specify whether you prefer with or without oatmeal

Ann Wood, Tamarack Ranch
PO Box 567, South Vienna, OH 45369-0567
Phone 937-568-4994
email tamarack@erinet.com

CASH MIRROR

2280 S. Church Rd.
Dallas, OR 97338

Bulk Rate
U.S. Postage
Paid
Permit #011
Dallas, OR
97338