pregnancy rates while not allowing any viable E+ fescue seed to be set in the year prior to seeding a smother crop the year after. In the study shown in the table above, Farm 3 heavy spring grazed both treated and untreated pastures to suppress seedhead formation, therefore an organic farm might be quite successful in suppressing seedhead formation by just grazing heavily in the spring when tall fescue ordinarily forms seedheads. Unlike a jointed grass like timothy, it only flowers once a year. This means to hit only one pasture at a time. A general recommendation is renovate less than 25 percent of your E+ tall fescue pastures a year anyway.

How do I know if the fescue in my pasture is toxic…? There are endophyte testing laboratories throughout the US. Oregon State's Forage Information System website has a list of laboratories, but is dated as of January 2008. It is a starting point to contact a laboratory before sending any samples in to confirm they still conduct the tests, the turn-around time, and to ensure that contact details, prices, and analyses have not changed. In addition to those labs listed by Oregon State, the University of Tennessee Soil, Plant, and Pest Center also can test for endophyte. They have a form that you can get on-line that can be used for various forage test procedures. The endophyte detection test costs fifteen dollars. It gives specific instructions on how to collect a tall fescue sample.

(Editor's Note: Why don't farmers get rid of E+ pastures? Living with E+ tall fescue requires cattle with a high level of tolerance to it and environmental adaptation. Many tall fescue belt beef cattle farms have been successfully selecting for fescue-tolerant cattle for years, or maybe if the cows did not die or lose extremities or not breed back, it just happened over time that the herd became tolerant to E+ tall fescue. These cattle have shown to be adaptable to a wide range of environmental conditions and thrive in low-input production models in conjunction with sound grazing management mentioned earlier. Light colored beef breeds seem to be more susceptible to ergovaline than dark breeds. This may explain why Black Angus are so prevalent in the tall fescue belt. The black coat of hair would seem to be not ideal in a hot, sunny, humid climate in summer. However, they will seek to wade in water or shade if it is available. It is also best, if buying replacement cattle, to purchase local cattle that have gained tolerance to grazing E+ pastures.)

Jerome Magnuson was the second speaker in this session. He is the Forage and Organic Specialist for DLF Pickseed NA, in Halsey, OR. The title of his presentation was "Advances in Tall Fescue Breeding". He started his presentation with an analogy about tall fescue growers' perceptions about tall fescue by likening their perceptions to 3 blind people feeling different parts of an elephant with one touching the trunk, another its tail, and the third person one of the legs. The person's experience with tall fescue may make them hate it, love it, or be ambivalent about it. They may only be familiar with one aspect of it depending on the variety they were dealing with and the environment it was placed in. He covered some of its varying varietal characteristics and some pitfalls of current nomenclature and ways of determining leaf softness.

He also explained why DLF Pickseed is located in Oregon. The Willamette Valley is ideal for grass seed production as it has rich soil and ample rainfall, but has a 60-day period with no-rain just as the seedheads on cool season grasses have emerged. This allows the harvest of high quality seed.

One personal bias of tall fescue is often based on cow preferences. Dairy cows grazing E+ tall fescue dominated pastures will tend to avoid it in the eastern US if there are other grasses or legumes growing in association with it and do not milk well on it if given no other choice. (Editor's Note: For instance, here is a quote from *Forage Fescues in the Northern USA*, "Where tall fescue was introduced in Wisconsin, it was found to be less palatable than most other grasses. It frequently set seed because it was not grazed, creating increasingly large patches of unpalatable forage in pastures. Between the animal health problems seen in the South and the observation that cows preferred other grasses, tall fescue was avoided by Wisconsin farmers.") However, this is not true in Oregon where dairy cows will eat E+ tall fescue. Perhaps less alkaloid is produced.

Jersey dairy cow on E+ tall fescue pasture in Oregon.

Today there is a lot of discussion about leaf palatability concerns. An on-farm trial for animal preference and adaption included these four general types of tall fescue by highest rank to lowest:

- Traditional leaf - most preferred
- Soft leaf second
- Traditional types next
- Coarse leaf (Fawn) last

The traditional leaf is a wide leaf found on E+ tall fescue and other tall fescues that are either E- or novel endophyte varieties. Soft leaf tends to have a more lax, narrower leaf blade. Coarse leaf typified by Fawn, an E- variety, is least preferred by livestock. It has a raspy leaf edge and the leaf is not easily sheared off when grazed. Although an E- variety, it is avoided since it is so wiry. Coarse leaf is not the best descriptor for a tall fescue leaf blade as it conflates leaf width and toughness (feel in the mouth). Tuscany II, an E- tall fescue, is between soft and coarse but is preferred by grazing livestock due its high sugar content. In this grazing trial, Tuscany and white clover was the most preferred plot. A soft leaf perennial ryegrass was also in this trial.

Factors that affect forage quality and preference:

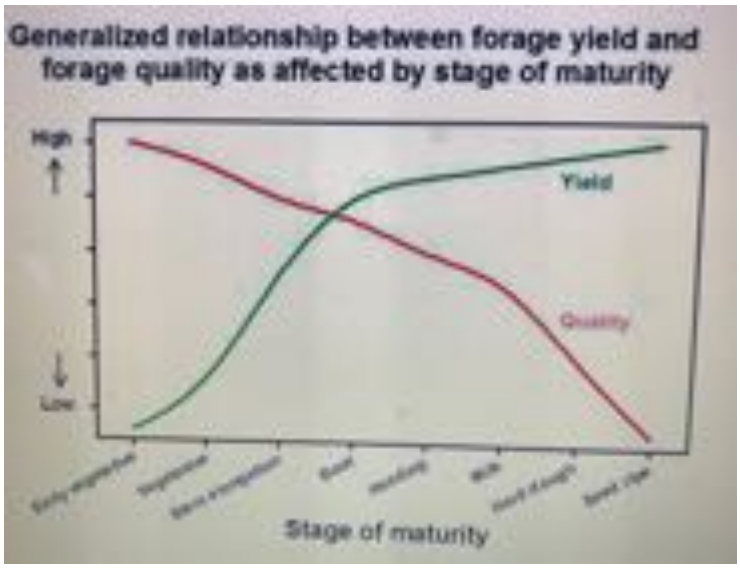
- Taste
- Soft leaf
- Variety Maturity
- Fiber Digestibility
- Silicate Content

Taste is a preference issue. It is a broad in scope based on the feel of the leaf (rough edges, hairiness [e.g. velvetgrass]), its shear strength (not easily removed from the plant crown or chewed), alkaloid content which imparts a bitter taste and more than likely causes post-ingestive feedback (the animal is not feeling so good after eating it), and other anti-quality factors such as coumarin

(smells great but is bitter [e.g. sweet clover and sweet vernalgrass]). New tall fescue varieties can be more palatable than perennial ryegrass.

Leaf texture is a qualitative trait measured and defined by plant breeders according to how harsh or soft the leaf texture feels by running the index finger over the leaf blade. This is can be highly subjective, but currently there are no other simple techniques available. Three categories established are:
- VVS (very, very soft leaf texture),
- VS (very soft leaf texture), and
- H (harsh leaf texture).

Soft leaf tall fescue varieties can run the gamut in softness and to a certain extent they are very imprecisely measured.



Range in maturity causes grazing discrimination. This can be a critical reason why tall fescue is avoided if it is earlier maturing than the other grasses in the pasture sward. Its quality is on the decline especially if it is producing seed stalks. Otherwise, as leaves mature later on in the growing season, they will be lower in sugar and tougher. Every grass going into reproductive maturity is avoided. Orchardgrass headed out is avoided and is highly criticized by graziers because it is unpalatable at that point. However, timothy, sweet vernalgrass, smooth bromegrass, redtop, and other grasses once headed out are also avoided. Jointed grasses, such as timothy, that head out more than once in a season are likely to be more of a problem if not rotationally grazed. (Editor's Note: If cutting grass for hay/balage, the graph above shows that it really needs to be cut at boot stage for the best combination of yield and quality.)

Range in maturity among tall fescue varieties is two weeks. Older USA genetics are early maturity varieties (Alta and Fawn) and are also coarse (harsh) type. (Editor's Note: Alta was selected for its tolerance of salinity and used in western US states on saline soils.) European genetics extend the maturity range and are typically soft leaf varieties.

Persistence of tall fescue varieties is dependent on several factors. Repeated grazing of European tall fescue varieties that are drought-stressed will deplete plant populations severely and is likely

to kill the pasture completely. Mediterranean varieties are likely to be more tolerant of grazing during drought, but grazing at such times still should be avoided. In the southern US, E+ and novel endophyte tall fescues are needed for heat tolerance persistence. In the northern tier of US states, endophyte-free (E-) varieties will persist well. (Editor's Note: From *Forage Fescues in the Northern USA*, "We have observed no effect of fungal endophytes in either toxic or animal-friendly forms on persistence or yield of tall fescue in Wisconsin." , and "Endophyte-free varieties of tall fescue will avoid the toxicosis issues and should have good survival if they have performed well in local variety trials.") South of the northern tier of US states, it will be a matter of elevation of whether or not E- tall fescue will survive as well as E+ or novel endophyte tall fescue. Higher elevations will reduce the need for an endophyte tall fescue. Some tall fescue varieties are more susceptible to winter kill than others, so in the northern tier of the US states use varieties that are winter hardy, such as Festival and Kora.

Tall fescue is a high yielding cool season grass, but select varieties that are adapted to the farm's area. It is best to look at forage trials done at various land grant universities that have climate and soils similar to those of the farm it is going to be raised on. Select varieties that are best adapted and give the best or similar yield to others in the trial. (Editor's Note: Penn State has conducted forage trials for many years at two locations in the Pennsylvania, Rock Springs in the mountains and Landisville in southeast PA. Cornell University at Ithaca, NY also has trial results for the major cool season grasses including meadow fescue over many years.) Use early maturity varieties on southern slopes in the Northeast to get an earlier start on grazing. Use a later maturity variety to stage growth for rotational paddocks so that the stage of maturity stays about the same from the early grazed paddocks to the later ones at least for the first round of grazing each year to avoid seedhead formation before the livestock get to the paddock.

Forage quality is measured four ways:

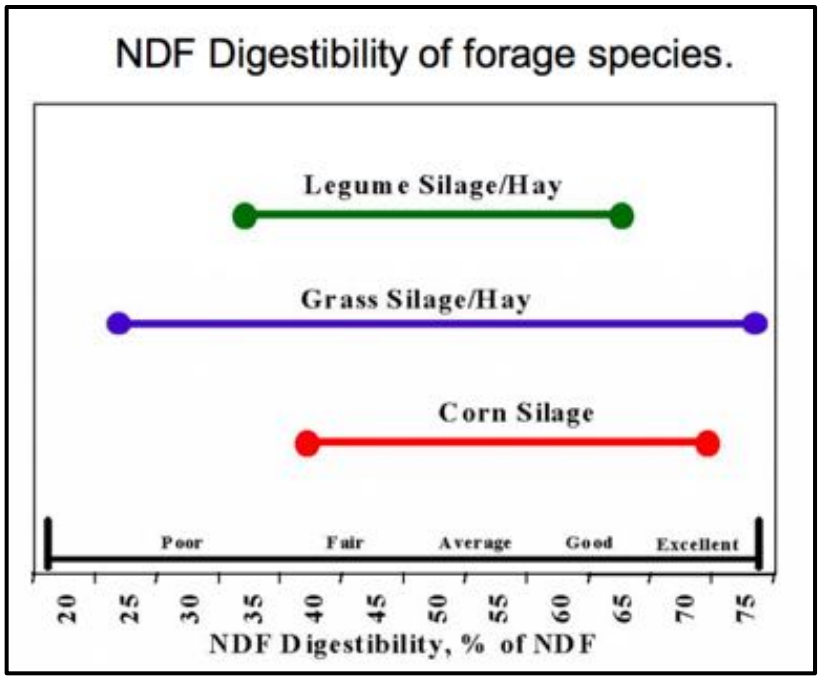
- ADF (acid detergent fiber),
- NDF (neutral detergent fiber),
- NDFD (neutral detergent fiber digestibility, and
- WSC (water soluble carbohydrates).

There are nuances to forage quality with tall fescue:

- Fiber digestibility in relationship to soft leaf and maturity,
- WSC versus fiber digestibility, and
- Differs whether it is grazed versus harvested feed.

(Editor's Note: ADF measures the amount cellulose in the forage plant's cell walls. NDF measures the cellulose and hemicellulose in the cell walls. NDFD is the digestible fraction of the hemicellulose and cellulose. Grasses have a very wide range of NDF digestibility because grass species are so diverse and are utilized at extreme ranges in maturity (e.g. grazing vegetative grass versus feeding straw). Grasses grown under cooler conditions or in northern latitudes have higher NDF digestibility than those grown further south or under hotter conditions. Within a growing season, grass forages can change as well, much of it due to going from cool to hot back to cool temperatures and the attendant soil moisture conditions. Forages are evaluated for NDF digestibility for

primarily two fundamental reasons: First, research has demonstrated that lactating dairy cows will eat more dry matter (DM) and produce more milk when fed forages that have higher NDF digestibility. Second, while lignin and acid detergent fiber (ADF) have been used in the past to estimate the potential digestibility of NDF and total forage digestibility, recent research has demonstrated that ADF and lignin do not account for all the variation in NDF or forage digestibility. WSC measures the sugars and starch (carbohydrates) of the cell contents, the mono and disaccharides, oligosaccharides, fructans, and starch. WSC is totally digestible while fiber is partially digestible. Soluble fiber is digestible. It slows down rate of passage through the gut. Insoluble fiber is not digested, and speeds up the rate of passage through the gut.)



Seed of newer soft leaf tall fescue varieties have been blended to achieve a higher level of NDFD blend. With laboratory analyses, Barenbrug identified significant differences in the amount of fiber (NDF) and its digestibility (NDFD) between improved varieties. STF-43 is a combination of varieties to provide exceptional levels of digestible fiber per pound of dry matter fed. Fed to high-producing animals, such as lactating dairy cows, STF-43 provides energy derived from digestible fiber as well as the valuable effects of fiber which together promote rumen health and productivity, and, in turn animal health and productivity. Tall fescue or any other grass grazed in the vegetative stage of growth will have NDFD in the excellent range as shown above. As grasses mature, whether or not they produce seedheads, NDFD will drift downward. Once some leaves start to senesce (turn yellow), NDFD will drop into the fair to poor range quickly.

Silicates in tall fescue appear to be a herbivory defense mechanism (Hartley & DeGabriel, 2016). Van Soest et. al. back in 1968 found an increase in silicates led to a decrease in digestibility. In 2016, Cougnon et. al. found that soft genotypes had fewer trichomes (2.74 mm−1) on the leaf margins than coarse genotypes (9.03 mm−1), but there was no relation between leaf softness or trichome number and digestibility ($R^2 = 0.05$), nor between silica content and softness or digestibility ($R^2 = 0.09$). In advanced breeding programs, it becomes difficult to discriminate the leaf softness between genotypes (A plant within a species assigned to a specific intraspecific group based on its genetic makeup). Moreover, there is evidence that the digestibility of the softest varieties is not necessarily higher compared to varieties with coarser leaves. (Editor's Note: How-