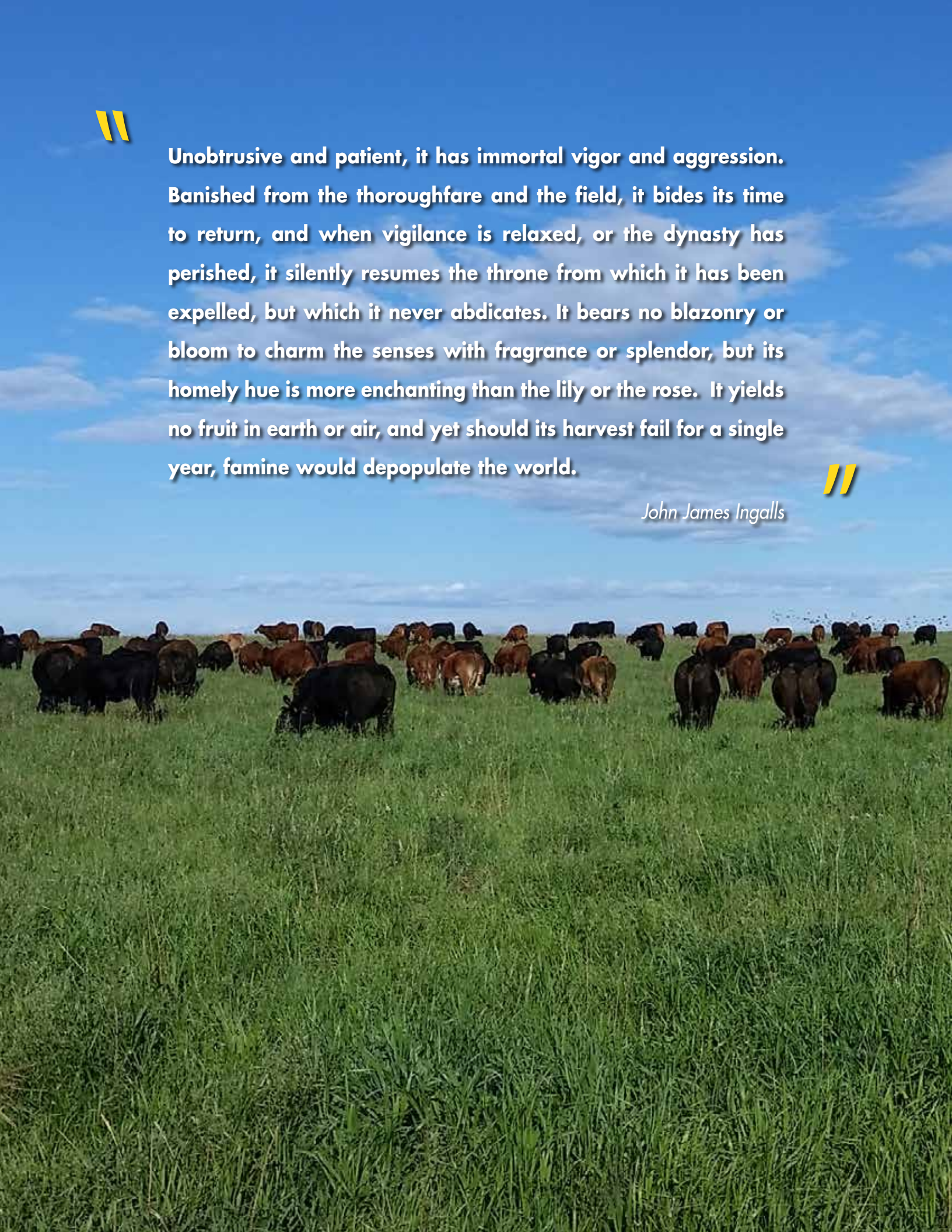
BARENBRUG®

FORAGE PRODUCT GUIDE



"Unobtrusive and patient, it has immortal vigor and aggression. Banished from the thoroughfare and the field, it bides its time to return, and when vigilance is relaxed, or the dynasty has perished, it silently resumes the throne from which it has been expelled, but which it never abdicates. It bears no blazonry or bloom to charm the senses with fragrance or splendor, but its homely hue is more enchanting than the lily or the rose. It yields no fruit in earth or air, and yet should its harvest fail for a single year, famine would depopulate the world."

John James Ingalls

BARENBRUG®

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Mission Statement:

Increase animal productivity to help feed the world and enhance the enjoyment of green spaces.

Highlighted products in this catalog have a code letter listed to the right of their name. Each letter indicates how the product can be used. For example, 'g' indicates that the product is suited for grazing. Likewise, the 'c' stands for cutting (silage or green chop) and so on. See Legend, below.

Legend

g – grazing	h – hay
c – silage & green chop	a – companion with alfalfa

Note: highlighted products are ones we recommend, based on their availability and planned usage.

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Passion for Breeding of Forage Grass and Legumes

Barenbrug has a Century long history of forage breeding at its multiple breeding stations around the world. These breeding stations are strategically placed to cover various climatic zones in different parts of the world. Even more importantly, a large network of locations is established where forage germplasm is evaluated for performance. Experimental and commercial germplasm from our various breeders around the world is evaluated at these locations in private and university trials. These locations are also used to make recurrent selections for various agronomic traits such as winterhardiness, drought tolerance, heat tolerance, and salinity tolerance. Survivors or superior genotypes are selected and moved to the breeding station for further screening and selection for Seed Production traits. In North America this breeding station is located in Oregon where it is further selected for Seed Production.

Superior germplasm is subjected to grazing pressure for added stress to breed varieties for grazing tolerance in different climatic regions. On the other hand distinctly different breeding schemes are used to breed varieties for Confinement dairies and grazing dairies. Varieties are characterized for maturity or heading. Late maturing varieties are preferred for grazing as they maintain quality longer in spring. Whereas early heading varieties are recommended for cutting hay under dryland conditions.

Forage varieties are also characterized for their winter dormancy versus winter activity. Winter active forages are desirable in areas with mild winter where winter grazing is feasible. But such winter active varieties are not suited for Canada. So Barenbrug has selected varieties with higher levels of winter dormancy for Canada which provides winter hardiness to the forage species.

Barenbrug has a unique selection scheme to select forages with higher palatability which leads to higher dry matter intake and consequently increased milk production or weight gains.

Meeting Customer Needs

Our R&D focuses on what our customer needs, even on what he is dreaming of. Barenbrug's R&D is inventive and aims to obtain scientific proof that all our products deliver on their claims. Our innovations are also supported by many official trials and top positions in the recommended variety lists across the world.

Think Global, Act Local

The Barenbrug R&D organization is decentralized with 15 locations on 6 continents in the main climate regions of the planet. This strategy provides knowledge and innovative products for local applications and climate conditions. In addition, this organization is supplemented by an international network of collaborations and strategic alliances with leading universities, research institutes and partner companies. These partnerships enable us to get the best out of plant genetics and seed technologies.

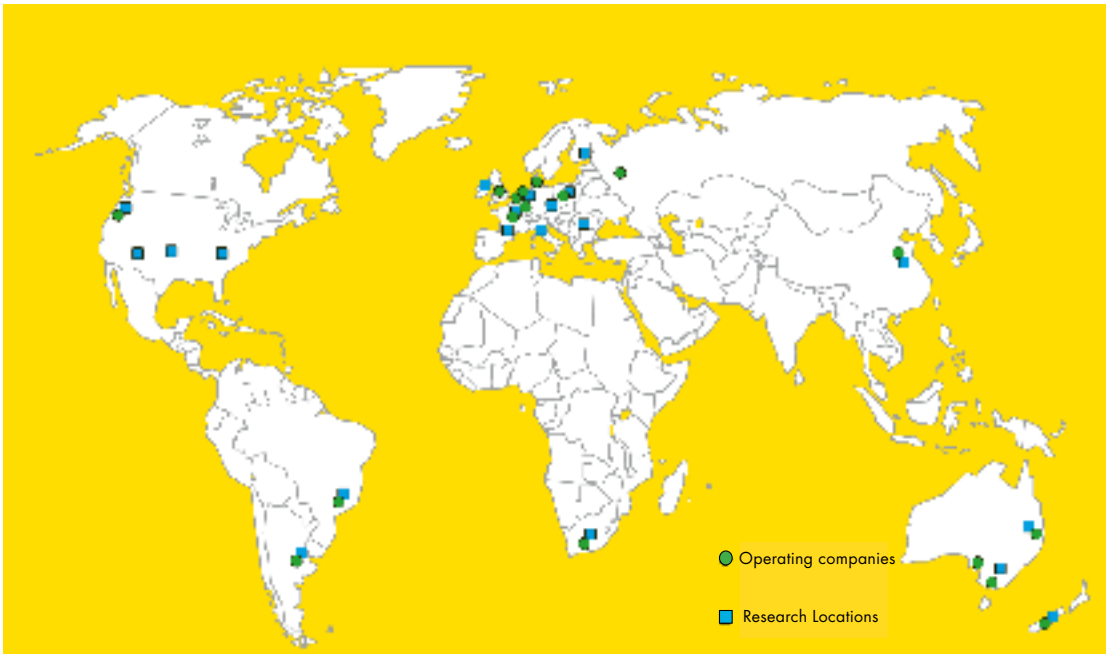
Barenbrug Research also collaborates with Plant breeders in public sector to develop innovative breeding techniques and varieties. Barenbrug Researchers are constantly seeking opportunities to invest in projects that will lead to significant advancement in forages and their applications. These projects are very long term and do not directly lead to development of varieties but help develop tools that will be utilized in breeding forages for many decades.

Our industry is rapidly changing. Dairies are reducing in number but becoming larger whereas beef operations are becoming smaller. These small beef cattlemen have needs for forages that are more versatile and less management intensive. Barenbrug breeders and agronomist understand these challenges and are developing products to meet these expectations.

Besides variety development, our plant breeders and agronomist work with university scientists and extension agents in designing and conducting various basic and applied cropping systems research involving forages. Barenbrug is a leader in organizing and sponsoring "Ask the cow" research projects where we test our forages in milk production trials in both Confinement and Grazing dairy cattle. Such projects have helped develop revolutionary forage quality measurement indices such as "TTNDFd" and highlighted the value of highly digestible grasses in High Producing Modern Dairy Cows.

Worldwide Research Locations

The Netherlands	Poland	Brazil
Northern Ireland	Czech Republic	New Zealand
France	Romania	Australia
Italy	USA	China
Finland	Argentina	South Africa



SPECIES SELECTION FOR PASTURE

Which species and varieties should be planted in a pasture? Which would be best for hay or silage? Do different classes of livestock need different forage species or varieties? These age-old questions continue to occupy the thoughts and discussions of farmers and ranchers. These discussions are always site specific, but Barenbrug distributors can offer some useful tools to help you make the right decision.

Some people believe that planting a field with a complex mixture of many grasses and legumes will result in a good stand. They believe that if one plants enough different species, most of them will establish and provide forage at different times throughout the year. This has resulted in many mixtures with 15 or more components and as little as two or three percent of certain ingredients. However, if you plant all the grasses and all the legumes in all the paddocks, you will end up with the ones that your pasture management dictates.

Andre Voisin, the father of Intensive Grazing Management (IGM), provided an example. He planted two pastures with white clover, orchardgrass and perennial ryegrass, then grazed them alternately every 10 days. He harvested the third pasture as hay. After a few years, the heavily grazed pastures were mostly perennial ryegrass and white clover; the pasture that matured as hay was predominately orchardgrass. The harvest management, soil type, fertility, drainage and forage species planted dictate the pastures you end up with.

Some believe that you should not try to improve a pasture at all. "Whatever Mother Nature provides is best." Mother Nature does, indeed, provide. But we can work with nature to produce more productive, long-lived and profitable grass stands. Improving an old, poor-producing grass stands can result in increased production and economic returns in as quick as one year while providing significant environmental benefits.

Economics of Forage Based Production Systems in $. Lardner et al. 2009, Lanigan, Saskatchewan

	Crested Wheat grass 2	Hybrid brome grass	Hybrid brome grass	Smooth brome grass	Meadow brome grass	Tall Fescue	Native pasture	Spring Wheat	Feed Barley
2004	-16.5	11.6	-26.7	-16.9	2.55	-	-	-152.4	-191.8
2005	83.0	84.7	-69.0	3.46	11.2	44.1	-99.0	-127.5	-179.0
2006	102.0	97.8	84.9	-24.6	77.0	54.6	-9.6	67.0	155.8
2007	80.5	161.6	97.9	61.7	123.8	210.7	-18.46	428.5	369.3
2008	-69.13	-	-53.42	-	-	102.0	-129.0	92.1	-121.6
Aver	36.0	88.9	6.7	5.9	53.6	102.9	-64.0	61.5	6.5

Fig. Economics of Forage based

For example a long term study conducted in Saskatchewan showed the value of renovating pastures irrespective of species selected for renovation in comparison to Native Pasture or a grain crop (Spring wheat or Feed Barley). Over a 5 year period, the native unimproved pasture system consistently lost money. However, if the pasture was renovated, irrespective of choice of species, it became profitable. The choice of higher energy species such as tall fescue or hybrid brome grass resulted in higher profits relative to lower energy species such as smooth brome.

Forage Differentiation

Forages can be divided into four categories: 1. High Energy; 2. Drought and Cold Tolerant; 3. Wet Condition; and 4. Harvested and Forage Crops. Here is a bit more information about these forage types:

1. High producing dairy cattle and finishing cattle or lambs require High-Energy forages, either as pasture or as harvested forage. These crops will return the highest profit and they should be on your best land. This allows you to maximize production for the lowest cost. The grass species that fit this category are Italian ryegrass, perennial ryegrass, soft leaf tall fescue and meadow fescue. For pastures, the addition of white clover and red clover creates a pasture that has high energy, high digestibility, high yields, good density and good palatability. The best grazing management for these forages is to graze at a high stock density for short durations and permit sufficient rest for regrowth. Proper grazing or cutting height is critical to maintain stand vigor and longevity.

2. On Farms that experience low winter temperatures and medium rainfall amounts, grass species such as smooth brome, and meadow brome are valuable choices. Addition of drought tolerant softleaf tall fescue to these pastures improves the overall energy level of these pastures. Softleaf tall fescue has good drought tolerance as it sends roots deeper to reach soil moisture. Regions that get decent summer rains, addition of a winterhardy orchard grass to the pasture base should be considered. For regions with extremely low rainfall, various wheatgrass species such as crested or intermediate are well suited. The quality of these wheatgrass pastures can be improved by addition of smooth or meadow brome. Addition of a drought tolerant legume such as alfalfa or sainfoin will further improve the quality of these pastures.

3. The impact of periods of excessive rain will vary, depending on soil type and topography. On farms with sandy soils, it isn't too hard to deal with excessive rain. On poorly drained soils, however, it can be a significant problem. Grazing when soils are too wet can damage grass stands through pugging and soil compaction. One way to minimize this is to plant some paddocks with species that that create a dense sod for wet weather grazing, such as Kentucky bluegrass or tall fescue, which form a durable sod. In regions with extreme cold and wet conditions timothy and Creeping Red Fescue are stable options for forage production.

4. Many forages can be harvested and stored as hay or silage for feeding later, or cut and fed as green chop. Stands of these forages could also be grazed during the year. Alternatively, some forages are planted and managed for grazing during periods of short base-pasture growth. See the Pinpoint discussion for options to fill in holes in your forage production calendar.

Yellow Jacket®

Enhanced Seed Coating

Barenbrug is an International Leader in innovative seed coatings. Its scientists are involved in research facilities worldwide to further enhance seed coating technology and bring Solutions to forage industry.

YELLOW JACKET®
ENHANCED SEED COATING

Yellow Jacket is a proprietary seed coating containing a totally natural product made from starch. This active ingredient in Yellow Jacket holds up to 600 times its weight in water and nutrients. Research at New Mexico State University, North Carolina State University and Texas A&M has proven that seed coated with Yellow Jacket established faster under less water and produced more forage than uncoated seed.

Yellow Jacket seed assures seedling establishment under dryland conditions where irrigation is not available. Yellow Jacket Seed provides higher yields while preserving our precious water resources. Yellow Jacket seed coating is available Exclusively on all Barenbrug Products.

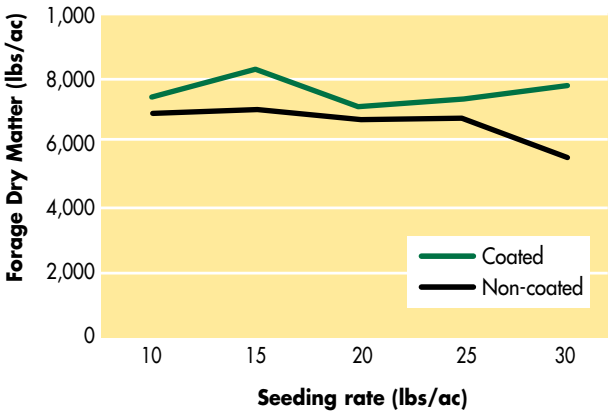
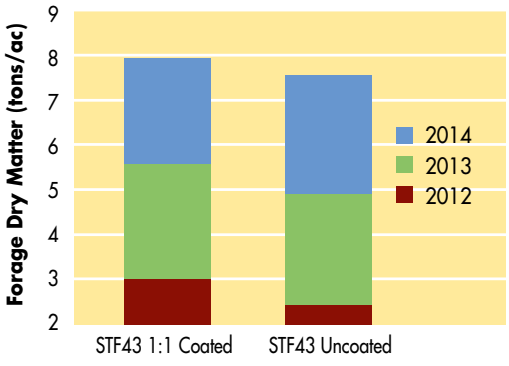


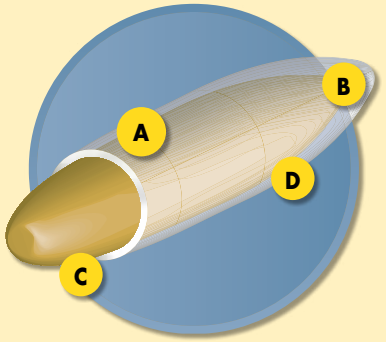
Figure. Yellow Jacket Coated Seed produced more Forage compared to Non-coated Seed in trials at Texas A&M

Yellow Jacket is like having an absorbent sponge or water reservoir around each individual seed. Once water is applied or moisture is available from rain, the coating holds both moisture and nutrients around the seed - making it available as needed for germination and establishment. Without Yellow Jacket, raw seed can quickly dry out, resulting in a need for more frequent irrigation or reliable rains.

University trials have also shown that Yellow Jacket absorbs and holds fungicides closer to the seed, thus protecting and minimizing seedling death due to damping off or Pythium. Yellow Jacket improves and prolongs the effectiveness of the fungicide in the root zone of the seedling.

STF-43 Soft leaf Tall Fescue Yield with Yellow jacket Coating
University of Nebraska, Lincoln • dryland conditions





A Unmatched absorbency
Each Yellow Jacket® micro–granule holds 600 times its weight in water.

B Made from cornstarch
Environmentally friendly and biodegradable.

C Higher germination rate
Applicable to a wide range of forage seeds.

D Air permeable
Yellow Jacket® freely allows air exchange.

Most Barenbrug forages are available with Yellow Jacket® Enhanced Seed Coating.

Pinpoint 300+

FORAGE DELIVERY SYSTEM

Pinpoint, Barenbrug's Forage Delivery System, is the cost-effective solution for seasonal feed supply challenges. The Pinpoint family of products work together as a system. This system helps increase profitability by lowering feed cost and reducing stress on the operation. Pinpoint products help producers achieve the goal of grazing for 300+ days out of the year.

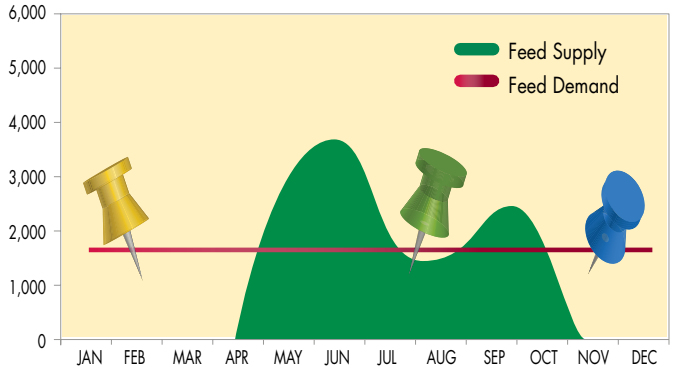
No matter which cool season or warm season perennial grass base is used, forage does not grow uniformly throughout the year. Moreover with long Canadian Cold winters, the forage gaps are large and stored feed can be needed from late October to late April. Pinpoint forages can be conserved / stored in field for direct grazing by animals or be prepared for swath grazing under the snow.

Livestock producers have to manage feed demand and feed supply, no matter what class of livestock or level of grazing management. The best grazers pay very close attention to minimizing periods of feed deficit or surplus.

Production records regularly indicate that winter feed costs are the single largest expense, and keeping feeding costs low is key to a profitable operation.

The Pinpoint family of products can provide a solution for timely forage needs. Even with ideal pasture and livestock management, periods of feed deficit still exist. Base forages have distinct growth curves that cannot meet the feed demand of grazing animals during every season of the year. Managers can plan for seasonal forage deficits. Pinpoint products can help fill these deficits.

Pinpoint Products Fill Forage Season Gaps



Lower Your Feed Costs

Feed grazed directly by animals will typically always be less expensive than conserved forage (hay, silage, baleage that is harvested and fed later). In addition, grazing animals recycle nutrients onto the pasture instead of concentrating them in areas where conserved forages are fed. Pinpoint products, along with other management changes, will allow growers to reduce their hay-feeding season regardless of where they're located.

Pinpoint products, as part of an improved management plan, can help you optimize the utilization of grazed forages and reduce dependency on supplemental feed, fuel and other inputs.

Clovers should be part of every improved pasture management plan. The biological nitrogen fixation they support reduces fertilizer cost, increases the crude protein content and improves feed quality. There are a number of species available to fit specific needs.

Forage Delivery System

Forage Delivery System: Over a Wide region of Canada, cows average only 6 months of grazing per year. Put another way, the average cattleman, from Ontario to British Columbia utilizes supplemental feeds nearly half a year despite the differences in climate and grass bases. Pinpoint products will allow producers to reduce their dependency on stored feed and associated labor costs by increasing their grazing days.

FIND THE PINPOINT PIN!

Look for the Pinpoint pins to find these products in our catalog!

SUGGESTED FORAGE MIXTURES FOR WESTERN AND EASTERN CANADA:

Red, White and Renew

g

Designed to improve forage quality and productivity of old pastures in average to high rainfall regions. 'Red, white and Renew' consists of winter hardy legumes with high productivity that can be frost seeded or no-tilled into pastures. The mix is highly suited for intensively grazed pastures under rotational or stock grazing. It provides nitrogen fixation and also improves the protein value of existing pasture. Contains Red and White clover varieties selected for high disease tolerance. Recommended Sowing Rate: 8 lbs/ac

Horsemaster®

Formulated Specifically For Horses

g,h

Horsemaster is a mixture made specifically for horse pastures. Because horses have both upper and lower teeth, they graze the grass close to the soil. Also, horses are very active animals and put a lot of traffic pressure on grass. Horsemaster mixtures have been designed to alleviate the close grazing and traffic pressure from horses. Barenbrug has developed different mixtures for different climates, but all mixtures include at least timothy, orchardgrass, and forage bluegrass. Horsemaster is guaranteed endophyte-free. Recommended Sowing Rate: 12 lbs/ac

Haymaster®

General Use Pasture Mixture

g,h

Barenbrug has developed the Haymaster grass seed mixture for producers of high quality grass hay. Producers who desire to market grass hay for its high RFQ value and superior visual appearance should choose Haymaster. Regionally adapted Haymaster mixtures have been developed that reach peak production at the ideal time to make hay such that it is not too early when fields are still flooded from spring rains; or not too late in summer before irrigation well starts to run dry. The two main components of Haymaster are soft-leaf tall fescue and late maturing orchard grass varieties. The leaf structure of softleaf tall fescue blends easily with orchardgrass leaves and provides the tonnage needed to make hay production profitable. Soft-leaf tall fescue varieties are more palatable and digestible than traditional tall fescues. Orchard grass varieties in Haymaster are disease resistant making the hay more visually appealing to the buyer. Recommended Sowing Rate: 15 lbs/ac

Browsemaster®

Premium Goat Mixture

g

Browsemaster is a new grass seed mixture from Barenbrug for goat pastures. Research has indicated that the productivity of goats is higher in a pasture with a diverse array of forage species rather than a mono-stand. Browsemaster has the optimum combination of browse, forbes and grasses to improve the meat and milk production in goats. The primary component of Browsemaster is Barenbrug's high quality chicory. Browsemaster also contains red clover, alfalfa and forage brassica varieties for protein and forage grass for digestible fiber. Recommended Sowing Rate: 10 lbs/ac

| **g** - grazing | **c** - silage and green chop | **h** - hay | **a** - companion with alfalfa |

FORAGE MIXTURES

FORAGE MIXTURES

Barenbrug offers the ideal combination of high quality forage products suited for your specific animal needs. We understand that digestive systems work differently between species. Even within the same species, different results are desired. With this in mind, Barenbrug is proud to offer our Master Series products. While choosing the correct product can be a daunting task, we have made it very simple so you can **plant with confidence**. Barenbrug forage mixtures can be adapted to your region.

SUGGESTED FORAGE MIXTURES FOR EASTERN CANADA:

Beefmaster®

Premier Pasture Mix g

Beefmaster is a special formulation of forage grasses for raising stocker cattle, as well as beef cows and calves. Beefmaster contains highly digestible, soft leaf tall fescue varieties which increases overall dry matter intake compared to rough-leaf tall fescues. In addition to the soft leaf tall fescues, Beefmaster's orchardgrass varieties maintain their productivity even under close grazing. Highly productive, high energy forage varieties in Beefmaster provide rapid weight gains in beef cattle. Beefmaster also contains new, persistent varieties of perennial ryegrass which further improve the forage quality of the pasture along with Large leaf white clover. Recommended Sowing Rate: 20 lbs/ac

Dairymaster®

Very High Energy g,c

Dairymaster is an exciting mixture, scientifically formulated to provide a quality pasture ideal for dairy applications. It is very suited for replacement heifers, lactating beef cows and stocker operations. Dairymaster contains the best of all species: perennial ryegrass, very soft leaf tall fescue and meadow fescue. All varieties used are winter hardy, persistent and high in energy and protein. Dairymaster also contains Alice white clover. Alice will fix nitrogen as well as improve protein and energy levels of the sward. Recommended Sowing Rate: 20 lbs/ac

Stockmaster®

General Use Pasture Mixture g,h

Stockmaster pasture mixtures are versatile, economical mixes. These regional mixes contain varieties that form vigorous and persistent pastures suited for all classes of livestock. The complex formulas allow them to be used even under less than ideal conditions. Stockmaster is a perfect mixture for smaller acreage fields that require a long lasting, high quality pasture. Stockmaster pastures may also be used for hay fields after establishment. Recommended Sowing Rate: 20 lbs/acpastures may also be used for hay fields after establishment.

SUGGESTED FORAGE MIXTURES FOR WESTERN CANADA:

Pinpoint Swath Grazing

g

Annual mix designed to fill the seasonal perennial grazing gaps and extend the grazing season. Pinpoint is a mixture of annual forage species that grow rapidly and accumulate dry matter for periods when the base perennial forage declines. It is Ideal for Swath Grazing. Barenbrug's Pinpoint contains grass, legume and forb varieties specifically selected for higher energy and protein. Contains Yellow Jacket coated forage and hybrid brassica; Greenspirit ryegrass; forage Teff and Sorghum; along with annual clovers such as berseem and Persian Clover. Recommended Sowing Rate: 4 lbs/ac

Nitromaster

g

Designed to improve forage quality and productivity of old pastures as well as a component of new forage plantings. Nitromaster is a mixture of perennial drought tolerant legumes that improve the protein production in the pasture and also fix nitrogen in soil to reduce the needs for Nitrogen fertilization. The forage species contained in Nitromaster are alfalfa along legumes selected to be low or non-bloating such as Sainfoin and Cicer milkvetch. Yellow Jacket coated. Recommended Sowing Rate: 5 lbs/ac

Grazemaster

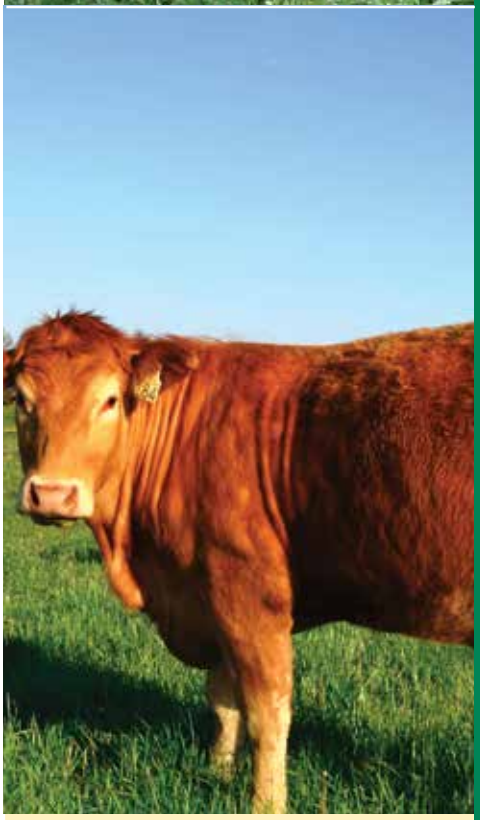
g, h

A very adaptable pasture mixture for Western Canada. Grazemaster contains drought tolerant grasses that are bred for high dry matter yields and superior energy values through improved fiber digestibility. It contains grasses from the breeding program of Barenbrug. Consider that many pastures in Western Canada need to renovated or interseeded with pasture seed to capture higher returns. Grazemaster is formulated to be high energy with STF tall fescue, meadow brome, HLR orchard grass and slender wheatgrass. Recommended Sowing Rate: 12 lbs/ac

Barricade

g

Designed for new planting or inter-seeding into Pastures and can be used in low rainfall areas. Barricade protects the pastures against drought as it contains the latest varieties of grasses selected for germination, establishment and growth under low rainfall. Barricade Seed is coated with Yellow Jacket which absorbs nearly 600 times its weight in water. This facilitates improved protection of seedling during germination and establishment by keeping a layer of moisture around the seed under below average rainfall conditions. Barricade is optimized with drought tolerant varieties of meadow and smooth brome; tall fescue; pubescent or intermediate wheatgrass. Recommended Sowing Rate: 10 lbs/ac



| **g** - grazing | **c** - silage and green chop | **h** - hay | **a** - companion with alfalfa |

HIGHLY DIGESTIBLE, EFFECTIVE FIBER FOR TODAY'S DAIRY

NutriFiber™

The Highly Digestible, Effective Fiber for Dairy Rations

Today's high-producing dairy cows require both Non-Fiber Carbohydrate (NFC) and Neutral Detergent Fiber (NDF). Properly balancing NFC and NDF is critical for animal health and profitable production. Table 1 below presents ration guidelines.

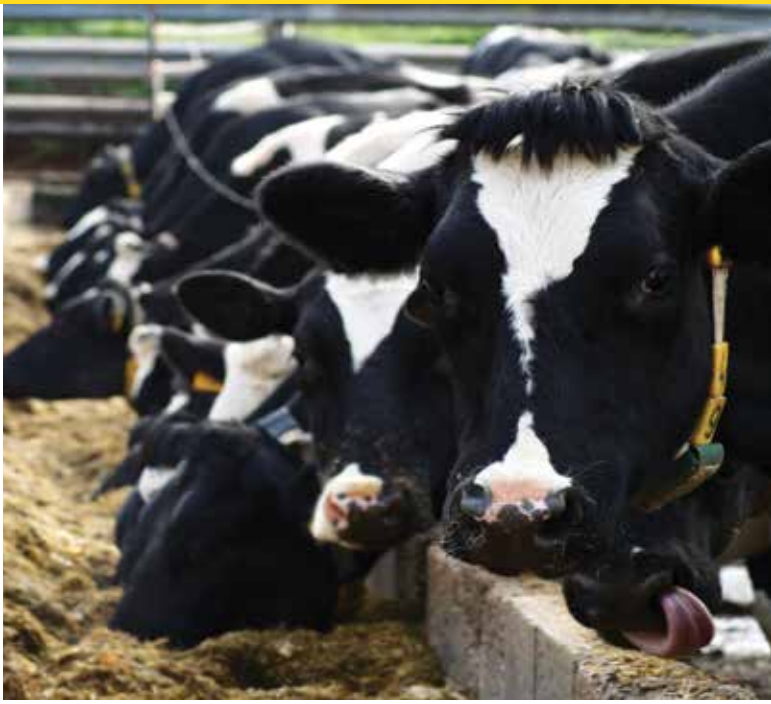
Table 1: Fiber guidelines for high producing cows

	NFC	NDF	peNDF	TTNDFD
	% of DM	% of DM	% of NDF	% of NDF
Ration Guidelines	≤40	28 to 30	75	≥43

Commonly formulated rations frequently contain too much NFC and too little highly digestible physically effective fiber. Unlike commonly utilized feedstuffs (Table 2), NutriFiber is ideally composed to properly balance high energy rations for today's high producing dairy cows.

Ruminants fed a diet high in water-soluble carbohydrates (sugars and starches) from grain and other pre-processed feeds can suffer in a number of ways. A lack of highly digestible, physically effective NDF (peNDF) plus an excess of rapidly fermenting grains and sugars can cause chronic lactic acidosis in dairy cows and other ruminants. Issues such as hoof problems, milk fat depression, high cull rates, transient diarrhea, unexplained death loss, clostridial infections or liver abscesses can be caused by Subacute Ruminal Acidosis (SARA).

Forages low in Neutral Detergent Fiber Digestibility (NDFD), such as mature alfalfa and grasses, corn stalks or even wheat straw, will provide fiber but can limit feed intake due to slow passage rate. The NDFD of commodities like corn gluten feed and beet pulp are high, but their total NDF content is relatively low and their NFC content is high (see Table 2), making it difficult to achieve the ration target shown in Table 1. Soy hulls do contain a relatively high amount of NDF that is highly digestible and have a low content of NFC, but they are low in the peNDF that cows need for cud chewing and proper rumen function.



Unfairly penalized

Plant fiber is a complex material that varies greatly in its digestibility. NDF is a forage test that measures the total amount of fiber in a feed. It has been understood for a long time that NDF is a measure of the "bulky," slow-to-digest feed component. The higher the NDF value, the less an animal could consume and the lower the forage quality. Some forages, such as cool season grasses, have higher NDF content than alfalfa, and have been considered lower quality as a result. This, it turns out, is an over-simplification.

Table 2: Feeds used to add fiber lower NFC

	NDF	TTNDFD	NFC
	% of DM	% of NDF	% of DM
Wheat Straw	73	24	12
Corn Gluten Feed	35	51	31
Beet Pulp	46	70	36
Soy Hulls	60	75	18
NutriFiber Forages	40 - 50	45 - 60	18 - 25

The truth is that NDF values cannot be compared between forage species. Not all NDF is created equal. Optimizing forage utilization by dairy cattle requires knowledge of the NDFD and the rate at which it digests.

NutriFiber™ forages increase butterfat level, improve herd health and maintain milk production.

Table 3: Fiber digestibility varies in forages

NutriFiber grasses are higher in fiber digestibility than other grasses with similar NDF Content*

	NDF range	TTNDFD
	%	% of NDF
Green Spirit^	46 - 56	59.5
Other grasses~	46 - 56	48.3

* Forage samples submitted to Rock River Labs, Watertown, WI in 2012
^ Values from 9 samples
~ Values from 448 samples

"Greater differences exist among grass varieties than among corn hybrids and soybean varieties."

- Dr. Dan Undersander, Univ. WI

A New Tool to Compare Forages

Relative Feed Value (RFV) has been widely used to rank forages for pricing, harvesting and allocation of forages to different groups of animals. It was largely influenced by Acid Detergent Fiber (ADF) and NDF values. Relative Forage Quality (RFQ) was developed as an improvement on RFV. The RFQ value incorporates digestible fiber, making it a better indicator of how an animal would perform on a given forage. But a basic limitation of RFQ is that NDF values from alfalfa, corn silage and grasses cannot be directly compared.

The Total Tract Neutral Detergent Fiber Digestibility (TTNDFD) procedure, developed at and licensed through the University of Wisconsin, provides estimates of quality that agree with in vivo literature across feeds.

This new forage quality assay can also be used in developing new varieties as a selection criteria in breeding programs. The NutriFiber trademark is your assurance that your forages have the highest genetic potential of producing the highest TTNDFD ration forage components for your high producing cows.

Table 4: NutriFiber compared to typical forage analysis

	NFC	NDF	peNDF*	TTNDFD
	% of DM	% of DM	% of NDF	% of NDF
Alfalfa	25	40	67 - 80	47
Corn Silage	45	40	67 - 80	40
Grass Forage	18	45	98	47
NutriFiber	18	45	98	55

"Acidosis is the most important nutritional problem that feedlots face daily and is a major challenge for dairies as well."[1] [It is] "Caused by a rapid production and absorption of acids from the rumen when cattle consume too much starch (primarily grain) or sugar in a short period of time, acidosis causes cattle to be stressed. As long as cattle are finished on grain, cows are grazed on cornstalk fields (grain consumption) or high energy (grain) diets are fed to dairy cows, acidosis will be an important problem."[2]

"... grains are subject to microbial fermentation in the rumino-reticulum part of the stomach complex. ... The microbial fermentation of starches contained in grains can proceed too rapidly causing the rumen to become acidotic. The severity of the acidosis may range from mild to life threatening."[1]

REFERENCES:

1. Acute and Subacute Ruminal Acidosis, Dr. Clell V. Bagley, D.V.M., USU Extension Veterinarian.

2. Acidosis, Rick Stock, Extension Feedlot Specialist and Robert Britton, Ruminant Biochemist, University of Nebraska.

Products with NutriFiber Technology:

Green Spirit® – Highest Quality Cool Season Grass

- Short season forage crop
- Increase corn silage yields in rotation
- Ideal for inter-seeding into thinning alfalfa
- Can be planted as straight stands

E² – Hybrid Alfalfa + Soft Leaf Fescues

- Higher yield than straight stands of alfalfa
- Improved stand life
- Higher digestible fiber yield than straight alfalfa
- Components matched for maturity

Milkway – Meadow & Soft Leaf Fescues

- Wide range of adaptation
- Highest quality perennial forage
- Traffic tolerant, ideal for multiple manure applications
- Improve butterfat and milk yield

STF-43™ – Soft Leaf Fescue

- Widely adapted perennial
- 10-15% better digestibility than typical tall fescues
- Long lived
- Ideal for nutrient management needs on large dairies

MEADOW FESCUE Festuca pratense

MEADOW FESCUE

Meadow fescue grows under cool, moist conditions, tolerating wet and sometimes flooded soils. Once established, it also performs well under drier conditions for making hay or silage. On good soils, meadow fescue surpasses perennial ryegrass in summer production. Meadow fescue is also a good companion to grow with alfalfa.

NutriFiber™

Milkway®

Effective Fiber and High Energy

Milkway contains fescue varieties that test and perform well in TMR of high producing dairy cows at the University of Wisconsin.

Research by numerous agronomists and dairy scientists indicates Barenbrug forage fescues are ideally suited for the TMR of high producing dairy cows North America. Barenbrug has created the ideal product so that dairymen can take advantage of benefits of Barenbrug forage fescues. Milkway contains high yielding meadow fescue and extremely digestible soft leaf tall fescue cultivars. Pradel meadow fescue provides exceptionally high NDFd and thus improved rate of digestion. It does not cause 'rumen fill' as it is one of the lowest NDF grasses that can be grown in the Northern USA. BarElite and Bariane soft leaf tall fescues are world renowned for their suitability for dairy TMR due to their low NDF and high NDFd values. Milkway is the ideal grass blend for TMR silage production; it provides stable NDF and NDFd throughout the season so the dairyman can pack different cuttings in the same bunk. Research shows that using Milkway grass blend in dairy TMR can improve milk production 5–15 percent over traditional wheat straw diets.

Milkway is planted as a monostand and produces high dry matter yields under manure application or with nitrogen fertilizer applications. It is traffic tolerant and can sustain multiple manure applications. Milkway is ideally suited for interplanting with alfalfa as its growth rhythm matches the growth rhythm of alfalfas grown in the Northern US. Unlike traditional grasses, it is not too competitive with alfalfa and will not take over the alfalfa nor does it disappear after a couple of years in an alfalfa stand.

HDR Meadow Fescue

Yield, Energy, Strength

HDR (**H**igh yielding, **D**igestible and disease **R**esistant) meadow fescue is developed for dairy and beef producers who are interested in providing the best energy grass for their livestock. HDR has varieties that are selected for high yields in Canada. HDR is the most digestible and high energy forage grass that can be grown in the continental climate of the US that is characterized by very hot summers and very cold winters. HDR contains Pradel, the most disease resistant meadow fescue variety on the market.

Meadow Fescue Dry Matter Yield (tons/ha) across Four Sites in Nova Scotia

	2012	2013	2012 + 2013
PRADEL HDR	5.96	5.14	5.64
COSMONAUT HDR	6.11	5.09	5.61
PREVAL	5.79	4.98	5.42
BARVITAL HDR	5.53	4.80	5.15
VAIRA	5.52	4.79	5.13
SILVA	5.33	4.54	4.93
STD ERROR	0.236	0.204	0.184

Barenbrug probably has the biggest breeding program for development of meadow fescue in North America and with it we are proud to bring to you the most advanced meadow fescue blend on the market.

Meadow Fescue Forage Trial, New Liskeard, Ontario, Seeded 2007

	2008	2009	2YR
		Kg/ha	
PRADEL	10589	7029	17619
MIMER	11087	6423	17510
EPIC	10336	6619	16955
LSD	1592.2	201.8	1530.0

Relative Forage Quality of Third Cutting, Arlintgon, Wisconsin, 2011 Sowing, 2012 Data

	CP	ADF	NDF	LIGNIN	SUGAR	Standardized TTNDFD	NDFd 30
Milkway	14.5	29.3	50.4	4.1	8.5	43.3	55.8
Pradel HDR Meadow Fescue	15.7	29.4	50.6	3.7	7.7	45.4	56.8
STF-43 tall fescue	14.8	32.3	53.2	2.5	7.9	44.0	54.8
HLR Orchard grass	18.0	33.7	54.6	3.7	3.5	42.4	52.0
LSD (P=.10)	1.6	1.6	2.2	0.6	1.0	2.3	3.2
CV	7.1	3.7	3.0	11.7	9.6	3.7	4.1

STF-43™

High Energy c,h,a

STF-43 is an innovative blend of late-leading, soft-leaved tall fescues. STF-43 produces impressive dry matter yields with exceptional levels of digestible fiber. STF-43 is the result of Barenbrug's forage analyses program which measured NDF (neutral detergent fiber) and NDFd (NDF digestibility).

With the laboratory analyses, Barenbrug identified significant differences in amount of fiber (NDF) and its digestibility (NDFd) between improved varieties. STF-43 is formulated with 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. STF-43 is well-suited for hay and haylage/baleage production. It is an excellent selection for a mixed or interplanting with a legume. STF-43 is late-maturing and endophyte-free.

NutriFiber™

STF-43 is ideal for interseeding into existing pastures to improve the energy levels for dramatically higher weight gains on beef calf cattle.

NDF (%Dry Matter) of Tall Fescue Cultivars in 2013, Chazy, New York. 2011 Seeding

	Cut 1	Cut 2	Cut 3	Average
Bariane STF	53.1	53.2	59.2	55.2
BarOptima STF	54.9	54.7	58.7	56.1
Tuscany II	56.9	54.0	58.5	56.4
Enhance	56.8	55.1	60.8	57.6
Kora	55.5	55.7	62.2	57.8
L.S.D. (0.10)	1.79	1.65	1.19	

Protein (%Dry Matter) of Tall Fescue Cultivars in 2013, Chazy, New York. 2011 Seeding

	Cut 1	Cut 2	Cut 3	Average
Bariane STF	18.9	14.8	10.7	14.8
BarOptima	19.3	14.7	10.2	14.7
Enhance	17.1	13.6	9.8	13.5
Kora	18.0	12.8	9.0	13.2
Tuscany II	16.8	12.1	9.3	12.7
L.S.D. (0.10)	1.17	1.17	0.62	

NDFD (%) of Tall Fescue Cultivars in 2013, Chazy, New York. 2011 Seeding

	Cut 1	Cut 2	Cut 3	Average
BarOptima STF	73.4	61.2	58.5	64.4
Tuscany II	70.1	61.6	61.4	64.3
Bariane STF	73.2	62.3	55.5	63.6
Kora	73.0	62.4	55.3	63.5
Enhance	70.5	61.2	57.1	62.9
L.S.D. (0.10)	1.99	3.29	2.21	

Palatability Results in 2003 Lancaster, Wisconsin Grazing Trial (2002 seeding)

	12-May	10-Jun	15-Jul	23-Sep	Average
Barolex STF	2.8	1.8	1.5	3.3	2.4
K5666V	3.0	2.0	1.5	1.8	2.1
Courtenay	2.8	2.0	1.0	2.3	2.0

TALL FESCUE

Tall fescue is a highly adaptable species which grows well in dry or wet conditions. It is also winter-hardy and persistent. Tall fescue grows early in the spring and has the potential for high dry matter production with nitrogen fertilization.

However, some tall fescue can, however, be unpalatable due to rough leaves and high lignin content. Barenbrug's breeding activities have led to soft leaf, higher yielding varieties with significantly improved palatability and digestibility.

Many varieties contain a harmful fungus called endophyte. This fungus makes the plant less palatable and depresses animal performance and health. In order to ensure good animal health and performance, none of Barenbrug's forage varieties contain harmful endophytes.

		Maturity	Palatability	Digestibility	Winter Hardiness	Suitability for Grazing
BarOptima	Very soft leaf	✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓✓✓
STF-43™	Soft leaf	✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓✓
Barolex	Very soft leaf	✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓✓✓
Bariane	Soft leaf	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓
BarElite	Soft leaf	✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓✓
Kentucky-31	Rough leaf	✓✓	✓✓	✓✓	✓✓✓	✓
Courtney	Rough leaf	✓✓✓	✓✓	✓✓✓✓	✓✓✓✓✓	✓✓
Fawn	Very rough leaf	✓	✓	✓	✓✓	✓

ITALIAN RYEGRASS Lolium multiflorum

GREEN SPIRIT®

Italian ryegrass provides excellent quality forage for up to two years, depending on climate and available moisture. Due to its quick regrowth, very early development in spring and prolonged growing period in the fall, this species usually has greater overall productivity than other cool season grasses. When planted in the spring, Italian ryegrass will not go to seed in the first season. This results in high quality forage production without the low quality stems and seed heads during the first year. Recently, Italian ryegrass has been recognized as the perfect rotation crop for plow down or emergency feed. Crops that follow a stand of Italian ryegrass also show higher yields, compared to other green manure crops.

As with perennial ryegrass, the tetraploid varieties of Italian ryegrasses have higher fresh-yield, high moisture content, broader leaves and are often more disease resistant, where as diploid varieties are more persistent and winter-hardy.

NutriFiber™

Green Spirit®

Diploid/Tetraploid

g,c

Use this perfect blend of diploid and tetraploid Italian ryegrasses as a rotation crop for fall planting. When planted in the spring, seed heads do not emerge during the first year. Green Spirit is a perfect high quality emergency feed. Compared to small grains, Green Spirit offers higher yields of higher quality forage for a lower seed cost.

The varieties used in Green Spirit require prolonged periods of cold weather for vernalization. Once vernalized, the plant has the ability to produce seed heads which result in the loss of forage quality. Inferior products that imitate Green Spirit vernalize with much shorter periods of cold, producing seed heads soon after planting when spring nighttime temperatures drop.

USES OF GREENSPIRIT

- Finishing Grass Fed Beef
- Winter grazing or Swath Grazing
- High energy ration component in TMR
- Effluent water nutrient recycling
- Nurse or cover crop for Alfalfa
- Emergency forage after Alfalfa winterkill

GREEN SPIRIT

SPRING PLANTED

- High dry matter production
- No seed head production*
- Very high forage quality
- Produces forage until late fall
- Generally overwinters and produces forage in the following spring and early summer in transition zone and Northeast

FALL PLANTED

- Better winter hardiness
- late heading in spring
- maintains better forage quality
- better regrowth after cutting

ANNUAL RYEGRASS

SPRING PLANTED

- High dry matter production
- Seed head production in late spring
- Reduced forage quality
- Only produces until mid-summer
- Stops growing after mid-summer therefore, does not overwinter.

FALL PLANTED

- less winter hardiness
- early heading in the spring
- reduced forage quality
- slow regrowth after cutting

Cumulative Summary of Italian Ryegrass Varieties seeded in 2011 and 2012 at Four Locations in Atlantic Canada.

		Tons/hac
Barmultra II Greenspirit	Tetraploid	5.26
Hunter	Tetraploid	5.23
Barextra Greenspirit	Tetraploid	5.19
Bardelta Greenspirit	Diploid	5.07
Fox	Diploid	5.03
Barprisma Greenspirit	Diploid	4.97
Lemtal	Diploid	4.94
St. Error		0.147

Annual Forages Trial, Lancaster, Pennsylvania 2012

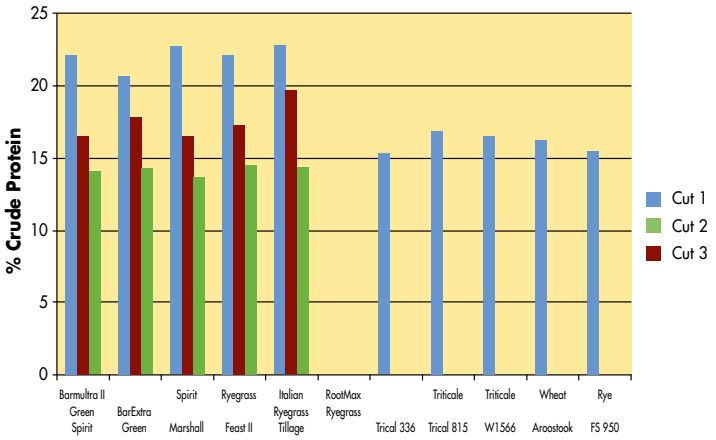


Chart 2. GreenSpirit produces significantly higher Crude Protein in than Triticale, Wheat and Barley forage.

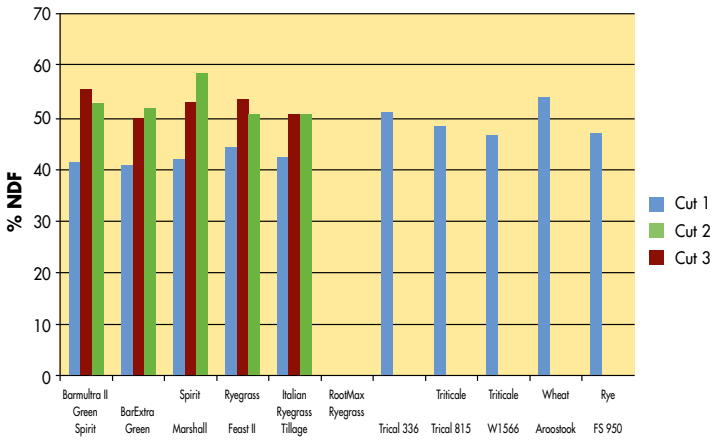


Chart 3. NDF (fiber) in GreenSpirit is lower than Triticale, Wheat or Barley Forage. This means more intake!

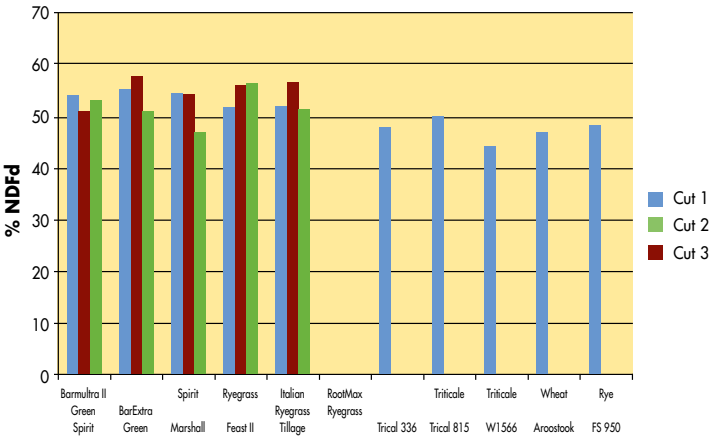


Chart 4. NDFd (Fiber digestibility) of GreenSpirit is significantly higher than other forages which means more Energy for better weight gains or milk production!

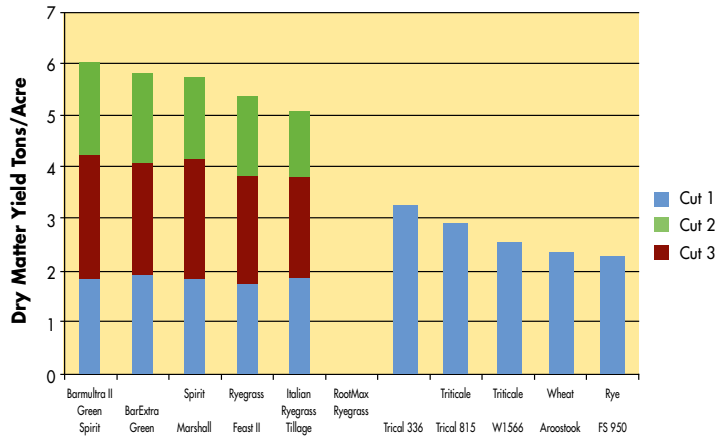


Chart 1. GreenSpirit when cut multiple times produces more dry matter than annual ryegrass, Triticale, Wheat and Barley.

"The dairy quality feed produced by Green Spirit is significant to our dairy nutrition program.

We have added it to existing alfalfa, planted it as straight stands and added it to our triticale to improve quality and tonnage.

We have seen better water retention and increase in soil organic matter following Green Spirit.

Green Spirit works very well in our nutrient management plan."

Denis Petrissans • Jai Alai Dairy

ORCHARDGRASS

ANNUAL RYEGRASS Lolium multiflorum westerwoldicum

ANNUAL RYEGRASS

Annual Ryegrass can be used for planting in spring in Canada for short term forage alone or in combination with Wheat,Oats, barley or triticale. It should be aggressively managed/harvested otherwise it will produce seedheads.

Jumbo

Rust Resistant and Late Maturing g,c

Jumbo is a late maturing tetraploid annual ryegrass, developed by Dr. Gordon Prine at the University of Florida. The superior rust resistance of Jumbo in varied environments is legendary. Jumbo has consistently performed well in forage trials throughout the annual ryegrass growing regions of the US. Jumbo exhibits cold tolerance, vigorous growth habit and high forage yields. The variety is suitable for mechanical harvesting (silage) as well as grazing.

Hercules

Tetraploid, Winter-Hardy g,c

Hercules outperforms other popular cultivars in the transition zone where winter hardiness in a variety is critical. Hercules is late maturing and very leafy, making it suitable for greenchop and grazing. If spring planted, it has low seed formation early in the season and hence better forage quality compared to other varieties.

BROMEGRASS Bromus ssp

BROMEGRASS

The Brome genus is a large family of varied grasses. Some species are extremely winter-hardy and persistent. Others exhibit an indeterminate seeding habit and persist through frequently dropped seed. Bromegrasses require high fertility levels and well-drained soils. Bromegrasses, in general, do well when planted as a companion with alfalfa.

2010 Bromegrass Trial, Cornell UniversityForage Quality at First Harvest 2012 – May 24

	Yield – Harvest 1 tons/ac	%NDF	%NDFD
Hakari	2.66	65	76
AC Knowles	2.17	65	72
Peak	2.97	66	69

Matua

Annual, High Yields g,c,h

Matua prairie brome (Bromus willdenowii Kunth) is a widely adapted prairie bromegrass. it is mainly an annual species but can last multiple years by reseeding itself under right management. It has a great track record as grazing species under irrigation in Sandy Soils. In Canada it is ideal for seeding hay fields as a grass companion for horse hay. It dries well to make good high quality hay. In addition its role in wastewater management is legendary. Matua seed is treated to prevent headsmut and processed to ensure that seed is free flowing during planting. Certified Matua is easily recognized by its pink color.

Hakari

Perennial, Winter-Hardy g,c,h,a

Hakari Alaska brome (Bromus sitchensis) is considered the Matua for colder climates in North America. It is a perennial species very fast to establish and regrow. Amongst bromes, it is a very late heading species and one of the highest in forage quality compared to smooth and meadow bromes. It is an ideal companion to alfalfa and other grasses in hay fields. Hakari is not susceptible to smut. VERY late heading compared to other bromes.

2010 Bromegrass Trial, Cornell University, Ithaca, NY

	2013		2012		2011		
	Total Season Tons/ac	Heading Date	Total Season Tons/ac	Heading Date	Total Season Tons/ac	Heading Date	3 yr. Total Tons/ac
Hakari	5.44	24-May	3.93	23-May	6.76	2-Jun	16.13
AC Knowles	5.71	22-May	3.28	10-May	5.61	17-May	14.59
Peak	6.53	19-May	4.84	13-May	6.67	20-May	18.04
LSD (.05)	0.62		0 .52			0.55	

ORCHARDGRASS Dactylis glomerata

HLR Orchardgrass

High Leaf Ratio g,c,h,a

Years of breeding efforts go into improving the forage quality and simultaneously the forage yield of orchardgrass varieties. HLR Orchardgrass contains the best and latest orchardgrass varieties from Barenbrug's breeding program. The varieties have been selected for high leaf-to-stem ratio which means more leaves for improved digestibility and energy, with less stems that reduce the palatability of the pasture. New diseases keep appearing in the orchardgrass pastures. Barenbrug breeders are continuously selecting for disease tolerance and HLR Orchardgrass is tolerant to rust and other leaf diseases. The intermediate to late heading varieties in HLR are ideal for interplanting with alfalfa.

Intensiv

Very Late Maturing and Winter-Hardy g,c,h,a

Intensiv is a very late maturing variety from Barenbrug. Intensiv is winter-hardy and has excellent disease tolerance (fusarium and leaf spot) making it quite persistent. Intensiv has a high leaf-to-stem ratio and the hay produced from Intensiv has excellent digestibility. With very late heading and high dry matter yields, Intensiv is highly suited for planting with alfalfa in mixed stands. Available in HLR.

2014 Cultivar Report for Nova Scotia, Perennia

ORCHARDGRASS	Mean Annual Yield 2 Yrs (t/ha)	# of site yrs tested
Persist	7.57	23
Baridana	7.42	23
Intensiv	7.47	23
Crown Royale	7.32	23
Tundra Late	7.47	9
Harvestar	7.42	9

Cornell University, Ithaca Orchardgrass trials 2011

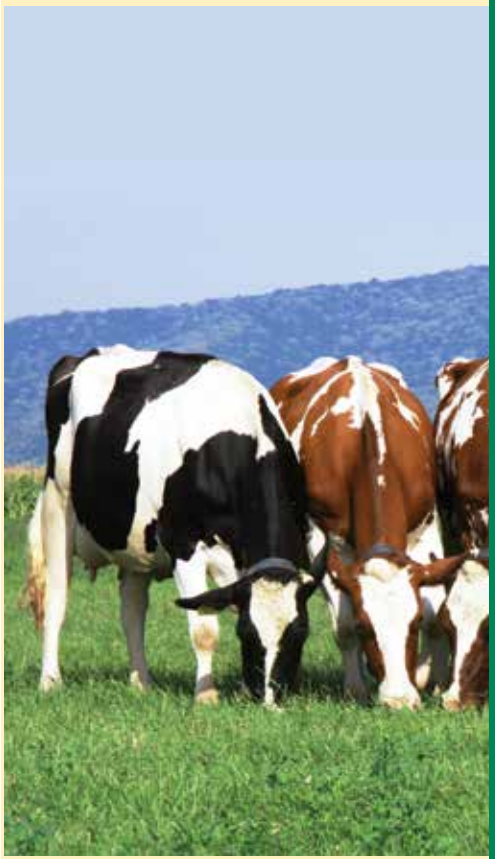
	2006		2007		Total
Variety	Total Season DM tons/Acre	Heading Date	Total Season DM tons/acre	Heading Date	2 year
Intensiv	5.5	25-May	3.69	24-May	9.19
Pizza	5.71	20-May	3.21	23-May	8.91
Baridana	5.52	17-May	3.58	22-May	9.11
Checkmate	6.3	17-May	3.98	18-May	10.29
Crown Royale	5.76	16-May	4.07	18-May	9.83
Stampede	6.34	15-May	4.34	17-May	10.68
Icon	6.47	15-May	4.13	17-May	10.6
Quick Draw	6.2	15-May	4.6	14-May	10.79

	Maturity	Palatability	Rust Resistance	Density	Winter Hardiness
Baridana	✓✓✓	✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓
HLR	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓✓✓
Kay	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓✓✓
Intensiv	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓✓✓
Potomac	✓	✓✓	✓	✓	✓✓

| **g** - grazing | **c** - silage and green chop | **h** - hay | **a** - companion with alfalfa |

ORCHARDGRASS

Orchardgrass is suited for light textured soils due to its outstanding drought tolerance. Varieties have varying degrees of winter hardiness. The species is rather slow to establish but has good persistency if managed properly. Orchardgrass is ideal for hay, silage and grazing. Once growth starts in the spring, orchardgrass tends to head



TIMOTHY/FESTULOLIUM

TIMOTHY *Phleum pratense*

TIMOTHY

Palatability and superior winter hardiness are timothy's most important features. It does very well on wet, peaty and heavily textured soils. Timothy tolerates cutting well and is used primarily as a hay crop. Barenbrug varieties perform well under grazing. Late maturing varieties are better suited for grazing.

Timothy Heading Date in New Liskeard, Ontario in 2013

Barpenta	**18-Jun**
Barfleo	**16-Jun**
Kara	**16-Jun**
Express	**16-Jun**
Treasure	**14-Jun**
Climax	**13-Jun**
Itasca	**13-Jun**
Aurora	**13-Jun**

Barfleo

Spring Production

g,h,a

Barfleo is an intermediate maturing variety with good spring production. It is well suited for dry hay production and has been the leading variety in many university forage trials across the country. Although timothy is not widely used for grazing, Barfleo has improved grazing tolerance and performs well in horse grazing trials. Barfleo can be used for pastures in high mountain regions and areas with deep snow cover in winter.

Barpenta

Very Late Heading

g,h,a

Barpenta is the latest improved timothy variety from Barenbrug. Despite being a very late-heading variety, it is a high dry matter yield producer. Barpenta is suited for timothy hay producers who like to diversify their acreage with varieties maturing throughout the season. This aids in spreading the hay swathing and baling workload throughout the season.

2006 Timothy Trials at Cornell University, Ithaca, New York

	2009		2008		2007		
	Total Season	**Heading Date**	**Total Season**	**Heading Date**	**Total Season**	**Heading Date**	**3 Year Total**
	T/A		**T/A**		**T/A**		**T/A**
Barpenta	5.90	12-Jun	3.59	10-Jun	5.95	10-Jun	15.44
Climax	5.63	1-Jun	4.30	9-Jun	5.59	3-Jun	15.52
Chazy	5.55	29-May	3.76	9-Jun	5.24	31-May	14.55
Crest	6.43	28-May	5.09	3-Jun	5.81	31-May	17.33
Clair	6.68	22-May	5.94	29-May	6.40	25-May	19.03
Summit	6.65	22-May	5.40	29-May	6.16	26-May	18.21
LSD (.05)	6.10		4.64		5.78		

	Maturity	Palatability	Digestibility	Winter Hardiness	Suitability for Grazing
Barfleo	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Barpenta	✓✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓	✓✓✓✓
Tenho	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓
Express	✓✓✓✓	✓	✓✓	✓✓	✓
Climax	✓✓✓	✓	✓✓	✓✓	✓

FESTULOLIUM *Lolium x festuca pratense*

FESTULOLIUM

Varieties of festulolium are obtained by crossing perennial or Italian ryegrass and meadow fescue. Festulolium combines winter-hardiness and forage quality. It establishes quickly and produces good forage in the spring.

Barfest

Winter-Hardy, Less Heading

g,c

Barfest is a late maturing festulolium variety developed for better persistence. Barfest is winter-hardy and highly palatable. It produces excellent dry matter yields in forage trials. Barfest also exhibits excellent rust resistance and performs well in heavier soils.

BG®-24T

Persistent and Productive g,c

BG-24T is a unique, innovative blend of early and intermediate maturing diploid and tetraploid perennial ryegrass varieties. Nearly a decade ago Barenbrug released BG-34, a blend with late maturing perennial ryegrass varieties. Since then Barenbrug breeders have selected new, more heat and cold tolerant perennial ryegrass varieties. Research has shown that under high summer temperatures, intermediate maturing varieties perform better than very late maturing varieties. These new varieties have better disease tolerance and perform better in the extreme environmental conditions of the cooler regions of North America. BG-24T consists of diploid perennial ryegrass varieties which provide stand density along with some tetraploid perennial ryegrass varieties which improve the overall palatability and productivity of the grass field.

BG®-34

Winter-Hardy and Late Heading g,c

BG-34 is a blend of the best late maturing winter-hardy diploid varieties of perennial ryegrass. BG-34 is the standard of high quality pastures and hay fields throughout the North America. Dairy farmers report milk production increases of up to 10 pounds of milk per cow per day when feeding BG-34 perennial ryegrass. Used in a pure stand or in a mix with white clover, BG-34 provides extremely high quality forage.

Perennial Ryegrass Forage Trial, Elora, Ontario, Seeded 2011

		2013	2012	
CULTIVAR	**Heading Date**	**Total Season**	**Total Season**	**2 YR. Total**
REMINGTON BG-24T	**7-Jun**	**6903**	**4621**	**11525**
INTRODA	1-Jun	6352	3805	10157
RESPECT	31-May	5815	4178	9993
MARA BG-24T	**5-Jun**	**5521**	**4178**	**9699**
TORONTO	31-May	5355	4156	9511
BARSPRINTER BG-24T	**3-Jun**	**5031**	**4240**	**9272**
CHICAGO	10-Jun	5292	3524	8815
DYNAMIC		4840	2130	6970
LSD		745.8	491.4	826.4

Perennial Ryegrass Test 2005, Kemptville, Ontario

	2006	2007
Variety	**tons/hac**	
Barsprinter BG-24T	**13082**	**10380**
Norlea	12004	10107
Remington BG-24T	**16320**	**9884**
Condesa	12931	8900
Bastion	16083	8363
Garibaldi	12560	7790
Tivoli	12829	7758
Spidola	14815	7635
Citadel	13119	7189
SE Mean		557.9

PERENNIAL RYEGRASS

Perennial ryegrass is the most widely grown cool season forage grass in the world. In the past, perennial ryegrass use in North America was limited because existing varieties were only adapted to regions with mild climates. In the last few years, Barenbrug has successfully introduced more productive and more persistent varieties into North America.

Perennial ryegrass is persistent if soil fertility is high. It also tolerates intensive grazing and cutting, re-growing quickly after defoliation. Since different varieties exhibit a wide range of characteristics such as maturity, winter hardiness, disease resistance, digestibility, dry-matter production and persistency, perennial ryegrass fulfills the needs of many different farming systems. Careful management and variety selection ensure the best results.

Perennial ryegrass is ideal for making high quality grass silage, cut and carry and grazing. It can also be planted with alfalfa.

Barenbrug offers straight perennial ryegrass varieties as well as blends. The benefit of blends is their wider adaptability in different areas.

ALFALFA Medicago sativa

ALFALFA

Alfalfa is the legume known as the "Queen of forages." It deserves this name because it supplies millions of animals with high quality feed throughout the world. Its taproot makes it heat and drought tolerant. Some of the problems with alfalfa are its lack of persistence, susceptibility to diseases and insects, as well as its ability to create bloat. Except for the latter, these problems can be controlled with selecting the right variety. Alfalfa is less suited for grazing because extensive livestock traffic can kill the crowns.

Alfalfa, while high in protein, is relatively low in energy due to cell walls that are not easily digested by animals. Adding a high energy grass (e.g., perennial ryegrass, orchardgrass or tall fescue) will increase energy levels in the hay.

NutriFiber™

E² Products are coated exclusively with:

YELLOW JACKET
ENHANCED SEED COATING

E² Energy X Energy h,c

Alfalfa is the mainstay forage for confinement dairies all around the US. It is rich in protein and is much sought after for its forage yields. After many years of research, in collaboration with university scientists and parallel grass breeding efforts, Barenbrug has made the King of Forages even more supreme. Barenbrug has perfected the synergistic combination of alfalfa with grass by identifying the cultivars and proportions that provide the maximum yield when planted together, as well as improving the energy value and nutritional properties of the silage.

E² ENERGY

Barenbrug, Great in Grass®, has partnered with Dairyland Seeds, the exclusive developers of hybrid alfalfa technology (msSUNSTRA®) in bringing this unique product to the market.

E² contains grasses that grow in the same rhythm as alfalfa.

E² contains grasses and alfalfa that have very high energy values, ideal for high producing dairy cows.

In E², alfalfa and grasses are formulated for sowing in a single pass in one drill box.

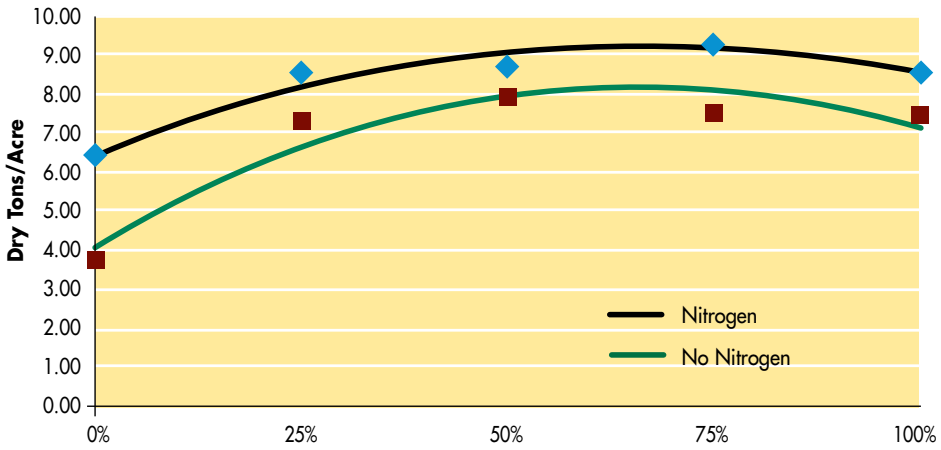
E² 631 High Energy Hay h

E2 631 is formulated for dry hay production. Besides hybrid alfalfa, it contains very late heading STF-43™ (soft leaf tall fescue) and very late heading HLR (high leaf ratio) orchardgrass. This combination results in high tonnage per acre throughout the season with a good balance of grass and alfalfa in the hay.

E² 640 High Energy Silage c

Formulated for high quality dairy silage, E² 640 contains hybrid alfalfa along with very late heading STF-43 (soft leaf tall fescue). E² 640 is formulated for high energy silage from all cuttings throughout the season.

Forage Yield with or without N at Different Alfalfa/Soft leaf fescue Ratios, Year 2 Total



RED CLOVER Trifolium pratense

Freedom! MR

Faster Drying, low dust — g,c,h

Freedom! MR is selected from Freedom! for mildew resistance. Six cycles of selection were conducted from Freedom! to develop Freedom! MR. Freedom! MR also has lower pubescence than Kenland but more pubescence than Freedom!. Freedom! MR is adapted to the upper transition zone, midwestern US and northeastern US where mildew can be a concern. Freedom! MR shows the same high yields as Freedom!

RED CLOVER

This legume is often used in grass mixtures predominantly for a cutting regime. Red clover is one of the fastest establishing legumes and can be grown on more acid soils. All Barenbrug varieties are bred for improved persistence and winter hardiness.

WHITE CLOVER Trifolium repens

Alice

Large Leafed, Winter Hardy — g,c

Alice has large leaves and grows to medium height. Alice exhibits tremendous nitrogen-fixing capacity that benefits its companion forage varieties. It is persistent and winter-hardy, making it the perfect companion for pastures in the northern US and Canada. Alice is aggressive enough to achieve a good balance with grass, while not overtaking the stand.

RegalGraze

Ladino — g,c

RegalGraze Ladino clover is most commonly used for cattle pasture. RegalGraze can be planted or seeded as a component of a pasture mixture with perennial grasses, or overseeded into established grass stands. RegalGraze is superior in forage yield with more grazing tolerance than other Ladino clovers in tests conducted by the University of Georgia. RegalGraze has no anti-quality cyanogenic glucosides, unlike some other white clovers.

| **g** - grazing | **c** - silage and green chop | **h** - hay | **a** - companion with alfalfa |

WHITE CLOVER

White clover is a perennial legume, which spreads by branching stolons. Like all other legumes, it produces its own nitrogen. Recently, farm trials have shown that these newer varieties release higher levels of nitrogen to the companion grass than older varieties. White clover is mainly used in grazing pastures for its high protein and energy values. Current studies show an increased dry matter intake of two pounds per cow, per day when white clover is added to the grass. A good mixture of grass and white clover can yield as much as pure grass receiving 175 pounds of nitrogen fertilizer per acre.

Barenbrug Clovers are Available with: YELLOWJACKET ENHANCED SEED COATING

FORAGE BRASSICAS/CHICORY

TURNIP Brassica rapa ssp. rapa

Forage brassicas are very useful for extending the grazing season when other forages are less productive. Forage brassicas provide high crude protein and very good cell wall digestibility. Forage turnips (Brassica rapa rapa) can be grown as a monostand or in mixed stands with forage grasses in late spring or early fall. They develop rapidly (12 weeks) to produce highly palatable and nutritious feed, thus reducing the winter concentrate feeding period by months. Turnips can be grazed by cattle and sheep. Turnips can also be lifted or dug and used for silage, as they have comparatively high sugar content in their enlarged roots/bulbs. Turnips have good feeding value with high energy and digestible protein (15 percent). Dry matter accumulation in turnips in October is similar to that of field corn in August. Plant in late summer to extend the grazing season to late fall or early winter.

Barkant Turnip

High Dry Matter Production g

Barkant is a very vigorous diploid turnip variety with a purple tankard root (50 percent the bulb is on top of ground). Barkant has high bulb yield with good top growth. It also has high sugar content which provides winter hardiness and increased palatability. Barkant has good tolerance to bolting and under a correct grazing management system can provide multiple harvests with up to 4-6 tons/acre of dry matter production in 60-90 days. Barkant is also suitable for stockpiling or strip grazing with sheep and cattle.

"For a winter plot for wildlife or livestock, I would highly recommend Barkant turnips, either straight or mixed with oats or wheat."

Lance Cote

T-Raptor Hybrid

High Leaf-to-Bulb Ratio g

T-Raptor is an early maturing hybrid brassica, a cross between a forage turnip and a forage rape, with 50-70 day crop duration. T-Raptor exhibits a leafy growth habit (higher leaf-to-bulb ratio) and is well suited to grazing. Under ideal management, it can be grazed once a month. T-Raptor is an excellent late summer feed source, and a good supplement for late summer periods when cool season forage grasses slow in production. T-Raptor can be sown in spring or summer.

FORAGE RAPE Brassica napus ssp. biennis

T-Raptor

Barsica

Disease Tolerant g

Barsica is a forage rape suitable for either grazing by livestock or cutting and feeding. It is high energy and has high digestible crude protien (up to 30% in the leaves). It is a tall variety with high yields and resistant to lodging. It is resistant to powdery mildew, making it highly palatable.

CHICORY Cichorium intybus

CHICORY

Chicory is a very special plant and is best described as an herb. Its taproot makes it drought resistant. It is best used as a component in grazing pastures, increasing overall palatability and animal intake. Chicory is high in energy and protein (30 percent plus) and is very palatable.

Forb Feast

Improve Pasture Nutrients g

New! A high quality, reduced bolting chicory blend. Reduced bolting equates to higher feed value. Leafiness of Forb Feast is impressive. It is an excellent source of digestible energy, protein and minerals. In addition, chicory has been shown to have key anti-parasitic properties in small ruminants. Forb Feast has proven itself in livestock and wildlife programs. Its deep taproot lends persistence and production in extreme heat and moisture stress. It also exhibits winter hardiness. Forb Feast is ideal as a component in a mixture with both warm and cool season grasses and legumes. Adapted from north to south.

When working with perennial forages, soil fertility is vital because it affects the quality of the forage. Animal health and production is related to the nutrients that the animal gets from the forage eaten.

The best way to determine the fertility level and fertilizer needs of a current or future pasture is from a soil test. Soil tests tell us the soil pH, nitrogen (N) recommendations, phosphorus (P) and potassium (K) levels and recommendations, as well as secondary and micronutrient status. For a new pasture, soil samples should be collected and analyzed well in advance to incorporate the types and quantities of recommended fertilizers into the soil at the time of field preparation. Simultaneously, lime should be applied to achieve a soil pH of at least 6.3. In addition to correcting pH, lime is a source of valuable calcium.

The pH of the soil is important, but determining why the pH is at a certain level is more important. The base saturation levels of calcium, magnesium, potassium, sodium and hydrogen determine the pH. You can have a high pH and still have a shortage of calcium in the soil. Calcium, however, is the one element that drives the production of quality forage. A good source of calcium is gypsum, which is calcium sulfate. Sulfur is also very important for creating high quality proteins in forages. Most soils are low in this element.

All grasses need nitrogen (N) on a continual basis to attain and maintain optimum production. Nitrogen is a vital fuel component for the plant, consumed daily as the plant grows. This is true even when grasses are planted with clover or other nitrogen-fixing legumes. Legumes are a money saving source of nitrogen, especially during the summer, and should be used where possible. Alice white clover can provide up to 150 units of N/acre/year.

Even with clover, about 150-200 unit/lbs of supplemental N/acre/year is about right for optimum production. This assumes that the proper levels of phosphorus and calcium are present. Without these, the performance of nitrogen alone is greatly reduced. Apply 50 units of nitrogen in the spring, as soon as the soil is 50 degrees or warmer. The remainder should be applied in 3-4 equal doses throughout the growing season, but not later than mid-September. Nitrogen should be applied with moisture for best results, either from irrigation or rain. On established pastures, take a soil test every 2-3 years, then top dress the recommended levels of phosphorus and potassium in the fall, allowing winter action to incorporate.

Persistency of forages is related to balanced fertility. A healthy plant is more likely to thrive over winter or over summer. All plants and animals need balanced nutrition, including micronutrients. Constant removal of nutrients will leave some soils very low in copper, zinc, manganese, boron, etc. Do not let the word "micro" fool you. You do not need much, but you do need a sufficient amount.

Figure 1. Adding fertilizer to a pasture makes a big difference in production.

Figure 2. Growing legumes, grasses and chicory together help make the whole sward healthier.

Figure 3. Growing legumes with grass adds nitrogen. Legumes must be inoculated to produce nitrogen.

Figure 4. This perennial ryegrass over-wintered much better where animals deposited urine during the last fall grazing.

MANAGING NEWLY SEEDED GRASSES & CLOVERS

First Weeks After Planting

Regularly check for emerging weeds. Spray to prevent weeds from becoming established. Clipping can also help control annual weeds.

First Harvest

Ideally, lightly graze a new stand of grass/clovers when conditions are dry. If the first harvest is going to be cut, do not cut too short. The new stand will have trouble coping with a short mowing first harvest.

First Spring

New stands of grass grow very rapidly in the spring. They NEED to be grazed or harvested frequently to keep leafy. Frequent cutting or grazing helps the grass to tiller and allows the clovers to establish.

Summer

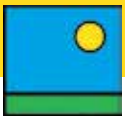
Be gentle on new stands of grass in dry conditions and on established stands on low organic-matter soils. Allow a stubble of at least three inches to remain, as grasses store their reserves above the ground in the basal stems. Keeping some length on the grass means better and faster recovery when rains come. Higher stubble heights also help protect soil and roots from high temperatures. Apply nitrogen periodically in conjunction with rain or irrigation. In addition, leaving slightly more base stem will improve the quality of the forage taken.

Fall

It is important to have grass stands go into the winter neither too short nor too long. Three inches is ideal for most grasses. Apply small amounts of nitrogen fertilizer after August in the Northeast US and upper Midwest. Elsewhere, the end of September is the appropriate time for nitrogen application. This allows the grass to slow down well before winter. If there is excessive growth in late fall, lightly graze the pasture when weather permits and do not allow the grass to grow too tall.

Winter

Only apply manure if the field is completely dormant or covered by snow. Applying manure on green, non-dormant grass might stimulate growth, causing winter injury.



TALL FESCUE

Bariane

Bariane is another soft leaf tall fescue with extremely high palatability and digestibility. Bariane is very late maturing, making it highly suitable for planting with alfalfa. It matures at the same time alfalfa is ready to cut in summer. Planting Bariane with alfalfa results in higher tonnage and the hay produced is ideal for dairies due to its easily digestible fiber and high energy. Bariane is a component of STF-43™.

BarElite

BarElite is the latest release from the Barenbrug breeding program which is already well known for its soft leaf tall fescues. BarElite was selected in the US after multiple screening trials. It has a unique combination of high forage yield and impressive digestibility values. BarElite is highly suited for producers who seek to produce and utilize high RFQ value forage. BarElite is a component of STF-43.

Barolex

Barolex is a quick establishing, soft-leaf variety with exceptional dry matter yields. This variety produces a dense sod and the leaf quality is similar to perennial ryegrass. Barolex is an outstanding variety selection for grazing applications.

ITALIAN RYEGRASS

Bardelta

Bardelta is a diploid Italian ryegrass variety which was selected after trials in the US. It proves to be a very high dry-matter producing variety. Bardelta has high crown rust resistance and excellent forage quality. Trials in Pennsylvania confirm this variety has excellent winter hardiness as well as persistence under grazing. Bardelta is a component of Green Spirit.

Barprisma

New diploid Green Spirit variety from Barenbrug. Barprisma strengthens the Barenbrug tradition of breeding varieties that do not head out in the summer after sowing in spring. Barprisma was selected for improved rust resistance, lower lodging and more drought tolerance. For producers which prefer Green Spirit as a winter forage it also has shown better winter hardiness.

Barmultra II

This is a very leafy tetraploid variety with good winter hardiness, outstanding initial growth plus excellent regrowth after cutting. Barmultra is extremely rust resistant and offers high DM yields.

Barextra

Barextra is a new and exciting Italian ryegrass variety. Barextra has shown impressive performance in university trials throughout the Midwest. It is a high yielding, winter-hardy tetraploid variety with superior rust resistance. It is more persistent than other Italian ryegrasses, making it suitable for both mechanical harvesting and grazing. Barextra is a component of Green Spirit.

PERENNIAL RYEGRASS

Mara

Mara is the standard for winter-hardy perennial ryegrass. Mara is a very high yielding and extremely grazing tolerant, persistent variety. It performs well from the transition zone with its hot, dry summers to upper Midwest with its extremely harsh winters. Mara is a component of BG-24T and BG-34.

Remington

Remington is a intermediate maturing tetraploid variety specifically developed by Barenbrug for producers in the North America. Remington was developed by doubling the chromosomes of a very winter-hardy ecotype from the mountains of Romania. Remington was tested (under the breeder's code LpTROM99) in numerous private and official trials in the US. It shows exceptional winter hardiness in Wisconsin, tolerance to heat and stand persistence in Kentucky and high dry matter production in New York trials. Remington is the key component of Tetra-Plus and BG-24T.

Barsprinter

This new variety was commercialized after superb performance in screening trials throughout the US. Barsprinter has very good winter hardiness along with excellent rust tolerance. It is noteworthy for stand density and is earlier heading than Mara. Barsprinter is a component of BG-24T and BG-34.

ORCHARDGRASS

Baridana

Baridana is a late maturing orchardgrass. It is a very winter-hardy variety with excellent rust resistance. Baridana produces a dense sward with few of the typical orchardgrass clumps. This makes Baridana well suited for pastures, as well as being high in digestibility and protein.

Common Name	Scientific Name	Establishment	Preferred Soil*	Minimum Precipitation	Drought Tolerance	Winter Hardiness	Persistence	Yield	Digestibility	Palatability	Seeding Rate	Seed/Lb.
Alaska bromegrass	Bromus sitchensis	Fast	L, M, H	16"	Moderate	High	Moderate	Moderate	High	High	35 lbs/acre	70,000
Alfalfa	Medicago sativa	Medium	L, M	17"	High	Moderate*	Moderate*	High	Moderate	Moderate	15-20 lbs/acre	210,000
Annual ryegrass	Lolium westerwoldicum	Fast	L, M, H	14"	Moderate	Low	Low	High	High	High	30 lbs/acre	210,000
Chicory	Cichorium intybus	Medium	L, M	16"	High	Moderate	Moderate	Moderate	High	Moderate	1-2 lbs/acre**	426,000
Festulolium	Festulolium loliaceum	Fast	M, H	14"	Moderate	Moderate	Moderate	Moderate	High	High	25 lbs/acre	250,000
Italian ryegrass	Lolium multiflorum	Fast	L, M, H	14"	Moderate	Moderate	Moderate	High	High	High	35 lbs/acre	190,000
Kentucky bluegrass	Poa pratensis	Slow	M, H	18"	Low	High	High	Low	Moderate	Moderate	5 lbs/acre	2,177,000
Meadow fescue	Festuca pratensis	Fast	L, M, H	20"	Moderate	High	Moderate	Moderate	High	High	25 lbs/acre	277,000
Orchardgrass	Dactylis glomerata	Slow	L, M	16"	Moderate	High*	High	High	Moderate	Moderate	10-12 lbs/acre	654,000
Perennial ryegrass	Lolium perenne	Fast	M, H	20"	Low	Moderate*	Moderate	Moderate	High	High	25 lbs/acre	277,000
Prairie bromegrass	Bromus wildenowi	Fast	L, M	14"	Moderate	Low	Low	High	High	High	35 lbs/acre	70,000
Rape	Brassica napus	Fast	L, M, H	12"	Moderate	Low	Low	Moderate	High	High*	3-5 lbs/acre	157,000
Red clover	Trifolium pratense	Medium	M, H	19"	Moderate	High	Moderate*	High	Moderate	Moderate	15 - 20 lbs/acre	272,000
Tall fescue	Festuca arundinacea	Medium	M, H	16"	High	High	High	High	Moderate	Moderate	25 lbs/acre	277,000
Timothy	Phleum pratense	Slow	M, H	22"	Low	High	Moderate	Moderate	High	High	10 - 15 lbs/acre	1,300,000
Turnip	Brassica rapa	Fast	L, M, H	12"	Moderate	Low	Low	Moderate	High	High*	3-5 lbs/acre	200,000
White clover	Trifolium repens	Medium	M, H	19"	Moderate	Moderate*	Moderate*	Low	High	High	2-3 lbs/acre**	800,000

*(L)ight, (M)edium, (H)eavy

*Variety dependent

**Mixed with grass

ADF: Acid Detergent Fiber; the fraction of the feedstuff not soluble by acid detergent; roughly comparable to a crude fiber plus lignin.

Carbohydrate: Organic substances containing C, H and O, with H and O present in the same proportions as in water.

CP: Crude Protein; the total ammoniacal nitrogen X 6.25, based on the fact that feed protein contains 16 percent nitrogen; many non protein nitrogen compounds may be included.

DM: Dry Matter is the portion of a feed or tissue remaining after water is removed by drying in an oven.

Kcal: Kilocalorie; 1,000 calories.

Lignin: A biologically unavailable polymer that is a major structural component of the cell walls of plants.

Mcal: Mega calorie; 1,000 kcal or 1 million calories.

ME: Metabolized Energy is digestible energy minus the energy of the urine and combustible gases from the gastrointestinal tract.

NDF: Neutral Detergent Fiber; the fraction containing mostly cell wall constituents of low biological availability.

NE: Net Energy is metabolizable energy minus the heat increment.

NEl: Net Energy for lactation.

NEp: Net Energy for production.

NEm: Net Energy for maintenance.

NFE: Nitrogen Free Extract consists primarily of readily available carbohydrates such as sugars and starches.

NPN: Nonprotein Nitrogen is any one of a group of N-containing compounds that are not true proteins that can be precipitated to form a solution; ammonia and urea are examples.

RFQ: Relative Forage Quality is relative forage value including digestible fiber.

RFV: Relative Feed Value is the estimated digestibility calculated from the estimations of ADF and NDF.

TDN: Total Digestible Nutrients are values that indicate the relative energy value of a feed for an animal.

TMR: Total Mixed Ration is the practice of weighing and blending all feedstuffs into a complex nutritional ration.

NDFD: Neutral Detergent Fiber Digestibility.

TTNDFD: Total Tract Neutral Detergent Fiber Digestibility.

THE BARENBRUG ADVANTAGE

At its core, Barenbrug concentrates on leadership in the research, production, marketing and sale of innovative grass seed products. Our focus and determination are evident in the solutions we develop for the industry. We are certainly one of the most innovative companies in our field. Because we exchange knowledge and new ideas throughout the world, we can offer tailored solutions in highly specific, localized cases.

Innovation

Innovation is fundamental to everything we do. Our worldwide research groups continually search for new ways to produce superior seed and bring more value to our customers. Plus, we work to make significant contributions to improve a world where the population will grow to 9 billion within a few decades. We improve farmers' productivity by reducing their consumption of water, fertilizers and pesticides.

Barenbrug USA Facility

Our 150,000 square foot central office and production/ warehouse facility has been open since early 1997. This ultra-modern structure was designed to efficiently accommodate our operations and volume of business well into the next century. Fast, accurate order processing and shipping are now – and will continue to be – the key to Barenbrug USA's success in the highly competitive grass seed business. This major investment in the heart of Oregon's Willamette Valley allows Barenbrug to improve the processing and speed the shipping of custom orders throughout the USA and Canada.

Partnerships

Our company would never have become the leader it is without strategic alliances with partners in research and development, grass seed production and sales and marketing. Throughout the world, we work with developers, universities and institutes to get the best out of genetics and seed technologies. We offer a stable and reliable source of income for the best grass seed producers in the world, through long-term relationships based on mutual trust. We also cooperate with local distribution and professionals in service, marketing and sales, aiming to provide the best applications of top-quality products for the customers.

International

Think global, act local. Because we exchange knowledge and new ideas with partners throughout the world, we can offer solutions tailored to highly specific, localized cases. Not only are we the best partner for our customers, but we also can offer a challenging platform for partners in technological developments, in existing markets as well as in developing regions.

Quality and Marketing

The Barenbrug brand is where all of our core values come together. Plus, our passion for the subject and the way we communicate it allow us to work together with our customers and our partners, with one vision in mind.

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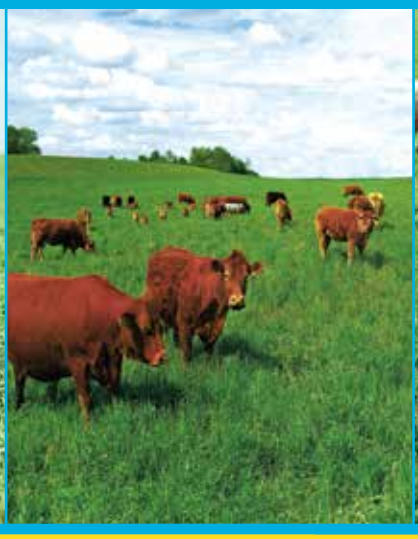
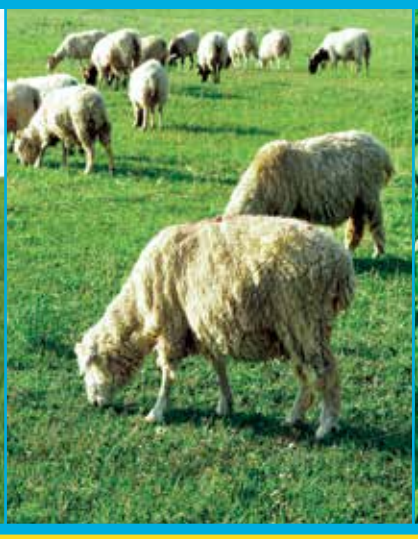


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