New Brunswick Soil & Crop Improvement Association Inc.
2-150 Woodside Lane Fredericton, NB E3C 2R9
Tel: 506-454-1736 Fax: 506-453-1985 www.nbscia.ca

CANADIAN AGRICULTURAL PARTNERSHIP

N.B. Forage Variety Evaluation and Management Trials

There are four trials, each with their own objectives, ongoing with this project. Here is a summary of progress on each of them:

1. Plot scale assessment of draft legume forage (alfalfa) fertility recommendations
Objective: To identify nutrient uptake and removal requirements of legume and grass forage stands at the higher forage yields being obtained and at medium fertility and pH levels

The forage research site was in Knightville in 2020. Due to Covid-19, work at the site was delayed, but an area did get planted to a straight alfalfa stand so that fertilizer treatments could be imposed in the spring of 2021. The planted alfalfa did establish reasonably well despite the drought-like conditions in 2020 and was deemed suitable to continue this work.
Testing of alfalfa response to potassium was conducted at two different locations in 2019, in Richmond Corner and 2021, Knightville, using replicated randomized block designs.
Potassium soil lest levels at these two sites were 108 M+ ppm and 84 M+ ppm respectively at the beginning of the seasons. These require fertilizer rates of 68 kg/K2O/ha under our traditional N.B. recommendations and 110 kg/K2O/ha under proposed ones. 2019 results would imply no differences cut to cut, whereas the season total appears to increase with higher rate of potassium.
In 2021 to fine tune this, a broader range of treatments was used. The yield appeared to be higher in the treatment that applied 127 kg/k/ha (approximately 150 kg/K2O/ha) in the first cut. Upon further in-season soil testing using a composite of the plots by treatment, that treatment had significantly higher soil test levels of potassium at 170 ppm of K or well over the H+ level of 148 ppm, all others being M+. This may have resulted in a higher yield for the first cut.
The results identify a need to soil test each plot for soil potassium when forage yield and tissue sampling are taken. In that way, a more thorough assessment of nutrients can be made across fertilizer treatments to see if an increased rate of potassium is justified.

2. Grasses legume mixture evaluation
Objective: To evaluate the effect of species interaction of Red Clover and Alfalfa (the legumes) with grass species with the potential for higher quality and yield in both complex and simple forage mixtures over the life of a sward.

The exceptionally dry climactic conditions at the Richmond Corner site during the 2019 growing season had a negative impact on establishment for all mixtures and species. Since most of the forage work moved to a new site in Knightville in 2020, these plots were abandoned.
The pandemic created numerous challenges with the establishment of the new forage site. It was not possible to properly prepare the site to accommodate perennial forage mixtures containing alfalfa (i.e., alfalfa autoxicity). The focus was placed on other components of this project that were able to be established and bring useable info to producers in a timely fashion.

3. Nurse or companion forage crop evaluation
Objective: To evaluate the role of annual forage species and cereals (oats, barley, peas, etc.) as a companion or nurse crop

The use of a cereal crop as a companion/nurse crop (referred to as companion crop from this point forward) has been a long-standing practice on many livestock farms in New Brunswick.
The idea behind this practice is that the cereal crop competes with weeds early in the growing season and ensures that a decent crop is realized in the establishment year. Some farms would harvest the cereal crop as mature grain and take the straw for use as bedding. Other farms opt to take the cereal crop as silage and depending on the year, take a subsequent cut of forage in mid-August. This system can penalize forage production the following year when the cereal crop lodges, grain harvest and/or silage harvest is later than desired for the forage crop to get satisfactory growth going into winter or the cereal crop is seeded at too high a rate.
Farms have moved away from the traditional oat or barley companion crops to using cereal/pea mixtures, annual ryegrass and even sudangrass being suggested lately.

Alfalfa was seeded alone and in combination with various companion crop options. The dry climactic conditions during the 2020 growing season impacted the establishment and performance of all combinations, but fortunately establishment was satisfactory and trial work could continue in 2021.
The establishment of the alfalfa was evaluated in the spring of 2021 by counting the number of plants in a 0.25m2 quadrate. More alfalfa plants were present when alfalfa was planted alone (no companion crop). The number of alfalfa plants in plots that had used either a low rate of oats or a low rate of oats and peas as the companion crop were less than the no companion crop treatment but were not statistically different from it. Only the no companion crop treatment and the low oat treatment had the required number of plants needed to be considered a healthy first pro-duction year stand (32-54 plants/0.25m2).
Yields of the treatments in the first production year (2021) was quantified. Samples were taken from the Hauldrop harvester for analysis at A&L Labs for forage quality and dry matter. This lab was chosen, because it offers a forage package that looks at the NDF digestibility of the forage; a parameter that is being requested by the industry. Dry matter yield in t/ha was averaged across the three replicates for each of the species and mixture treatments and an ANOVA were conducted between treatments.
Treatments that used at least some amount of annual ryegrass as or in the companion crop had the highest yield. This was not expected as annual ryegrass generally does not survive our winters. However, it should be noted that an Italian type ryegrass was used in this trial, which in more milder climates can be a biannual. The winter of 2020 was obviously mild enough for it to survive. In retrospect, the investigators should maybe have used a Westerwolds ryegrass, a true annual species, for this application.
The no companion crop treatment was the fourth highest yielding, although not statistically different from any of the others. It will be important to continue to monitor plots over time to see what the long-term implications of using companion crops will be.

4. Emergency or annual forage crop evaluation
Objective: To evaluate numerous plant species for suitability as emergency forage crops in New Brunswick livestock farms.

Background: An extremely dry growing season in 2018 and widespread winter kill in 2019 left N.B. livestock producers scrambling to find crop options that would provide them enough feed for their animals.
Annual species including corn silage, hybrid pearl millet, sorghum-sudangrass, hybrid sudangrass, Italian ryegrass, teff, forage oats and peas, silobuster, fall rye and forage soybeans were all established in replicated plots at the Knightville site to assess their ability to provide a high-yielding and high-quality source of feed in a single season following challenging growing conditions. The parameters of evaluation were wet yield, dry matter yield and numerous quality parameters which included a calculation for milk yield per hectare.
Digestibility of the forage, an analysis request industry is making, was part of the lab analysis, as well as forage quality and dry matter.
Potential annual forage species and mixtures were established in a RCBD. Winter cereals were planted Sept. 21, 2020 for harvest in the spring of 2021. This included fall cereal rye drilled, fall cereal rye broadcast, winter triticale and a mix of fall cereal rye, winter triticale and balansia clover. Spring cereals and cereal mixes were planted May 24, 2020 and included oats, oats and peas, silobuster, oats, peas and annual ryegrass. Warm season annuals were planted June 14, 2021 and included a forage sorghum, BMR sorghum-sudan grass, Canadian forage pearl millet, Japanese millet, hybrid, pearl millet, teff and a sorghum-sudangrass mix which included annual ryegrass, red clover, balansia clover, berseem clover and crimson clover. A forage soybean and buckwheat were planted at this time too.
Buckwheat had the lowest yield of all the crops planted. Due to the nature of the crop, only one cut makes up its seasonal total. However, it is important to note that it was ready to be harvested in just over thirty days, making multiple plantings in a single season possible. The costs associated with seed and multiple plantings would need to be considered to determine if this would be cost effective. In situations where a quick crop is needed, buckwheat could fit. The suitability of any crop is ultimately determined by the forage production system available on the farm.
Forage soybeans had the highest yield of all the crops planted, although not statistically higher than over half of the options that were evaluated. Due to the nature of the crop, it was harvest only once on Sept. 17. At this late in the growing season, wilting of this amount of biomass may prove challenging on a farm scale and would need to be considered when growing this crop.

Forage quality parameters were assessed for first and second (if applicable) cuttings. Only the results for milk yield per tonne (MPT) of forage of the first cutting are reported here (Figure 4).
When dry matter yield and the MPT index are combined, a seasonal milk yield per hectare value can be obtained. Producing the most forage on the least land usually results in the largest return on investment. However, depending on what type of animal is being fed and the specific operation, quality may play a larger part of crop selection. Figure 5 reports the seasonal milk yield for all the crops grown in this trial. Even though buck-wheat had one of the highest MPT indexes, its low yield resulted in it showing the lowest estimated milk yield per hectare of all the crops grown. Estimated milk yield per hectare of the other crops varied between species.

Essais d'Évaluation et de Gestion des Variétés Fourragères au N.B.

Il y a quatre essais, chacun avec ses propres objectifs, en cours avec ce projet. Voici un résumé des progrès réalisés sur chacun d'eux:

1. Évaluation à l'échelle des parcelles des projets de recommandations sur la fertilité des légumineuses fourragères (luzerne)

Objectif
Identifier les besoins en absorption et en élimination des nutriments des peuplements fourragers de légumineuses et d'herbes aux rendements fourragers les plus élevés obtenus et aux niveaux de fertilité et de pH moyens
Sommaire
Le site de recherche sur le fourrage était à Knightville en 2020. En raison du Covid-19, les travaux sur le site ont été retardés, mais une zone a été plantée sur un peuplement de luzerne rectiligne afin que des traitements d'engrais puissent être imposés au printemps 2021. La luzerne plantée s'est raisonnablement bien établie malgré les conditions de sécheresse en 2020 et a été jugée appropriée pour poursuivre ce travail.
Des tests de la réponse de la luzerne au potassium ont été effectués à deux endroits différents en 2019, à Richmond Corner et en 2021, à Knightville, en utilisant des modèles de blocs randomisés répliqués.
Les taux de potassium dans le sol sur ces deux sites étaient respectivement de 108 M+ ppm et de 84 M+ ppm au début des saisons. Cellesci nécessitent des taux d'engrais de 68 kg/K2O/ha selon nos recommandations traditionnelles du N.B. et de 110 kg/K2O/ha selon celles proposées. Les résultats de 2019 n'impliqueraient aucune différence d'une coupe à l'autre, alors que le total de la saison semble augmenter avec un taux de potassium plus élevé.
En 2021, pour affiner cela, une plus large gamme de traitements a été utilisée. Le rendement semblait être plus élevé dans le traitement qui appliquait 127 kg/k/ha (environ 150 kg/K2O / ha) dans la première coupe. Après d'autres essais de sol en saison utilisant un composite des parcelles par traitement, ce traitement avait des niveaux de potassium significativement plus élevés à 170 ppm de K ou bien au-dessus du niveau de H+ de 148 ppm, tous les autres étant M+. Cela a peut-être entraîné un rendement plus élevé pour la première coupe.
Les résultats indiquent la nécessité de tester le sol de chaque parcelle pour le potassium du sol lorsque le rendement en fourrage et l'échantillonnage des tissus sont prélevés. De cette façon, une évaluation plus approfondie des nutriments peut être effectuée à travers les traitements d'engrais pour voir si une augmentation du taux de potassium est justifiée.

2. Évaluation du mélange de légumineuses graminées

Objectif
Évaluer l'effet de l'interaction des espèces de trèfle rouge et de luzerne (les légumineuses) avec des espèces d'herbe avec le potentiel d'une qualité et d'un rendement plus élevés dans des mélanges fourragers complexes et simples au cours de la vie d'un essaim.
Sommaire
Les conditions climatiques exceptionnellement sèches sur le site de Richmond Corner au cours de la saison de croissance 2019 ont eu un impact négatif sur l'établissement de tous les mélanges et espèces. Comme la plupart des travaux de fourrage ont été déplacés vers un nouveau site à Knightville en 2020, ces parcelles ont été abandonnées.
La pandémie a créé de nombreux défis avec la mise en place du nouveau site de fourrage. Il n'a pas été possible de préparer correctement le site pour accueillir des mélanges fourragers pérennes contenant de la luzerne (c.-à-d. atoxicité de

la luzerne). L'accent a été mis sur d'autres éléments de ce projet qui ont pu être établis et apporter des informations utilisables aux producteurs en temps opportun.

3. Évaluation des cultures fourragères nourricières ou compagnons

Objectif

Évaluer le rôle des espèces fourragères annuelles et des céréales (avoine, orge, pois, etc.) en tant que compagnon ou infirmière.

Sommaire

L'utilisation d'une culture céréalière comme culture compagnon/nourrice (appelée culture compagnon à partir de maintenant) est une pratique de longue date dans de nombreuses fermes d'élevage au Nouveau-Brunswick.

L'idée derrière cette pratique est que la culture céréalière est en concurrence avec les mauvaises herbes au début de la saison de croissance et garantit qu'une récolte décente est réalisée l'année d'établissement. Certaines fermes récoltaient la céréale comme grain mûr et prenaient la paille comme litière. D'autres exploitations choisissent de prendre la récolte de céréales comme ensilage et, selon l'année, de prélever une coupe ultérieure de fourrage à la mi-août. Ce système peut pénaliser la production de fourrage l'année suivante lorsque la culture céréalière se loge, la récolte de céréales et / ou la récolte d'ensilage est plus tardive que souhaité pour que la culture fourragère obtienne une croissance satisfaisante avant l'hiver ou que la culture céréalière est ensemencée à un taux trop élevé.

Les fermes se sont éloignées des cultures compagnons traditionnelles d'avoine ou d'orge pour utiliser des mélanges céréales/pois, le ray-grass annuel et même le sudangrass étant suggérés ces derniers temps.

La luzerne a été ensemencée seule et en combinaison avec diverses options de cultures compagnes. Les conditions climatiques sèches de la saison de croissance 2020 ont eu un impact sur l'établissement et la performance de toutes les combinaisons, mais heureusement, l'établissement a été satisfaisant et les travaux d'essai ont pu se poursuivre en 2021.

L'implantation de la luzerne a été évaluée au printemps 2021 en comptant le nombre de plants dans un quadrilatère de 0,25 m2. Plus de plants de luzerne étaient présents lorsque la luzerne était plantée seule (pas de culture compagnon). Le nombre de plants de luzerne dans les parcelles qui avaient utilisé soit un faible taux d'avoine, soit un faible taux d'avoine et de pois comme culture d'accompagnement était inférieur au traitement sans culture d'accompagnement, mais n'était pas statistiquement différent de celuici. Seuls le traitement sans culture associée et le traitement à faible teneur en avoine avaient le nombre requis de plantes nécessaires pour être considérées comme un peuplement sain de la première année de production (32 à 54 plantes/0,25 m2).

Les rendements des traitements de la première année de production (2021) ont été quantifiés. Des échantillons ont été prélevés de la moissonneuse-batteuse Hualdrop pour analyse dans les laboratoires A&L pour la qualité du fourrage et la matière sèche. Ce laboratoire a été choisi, car il propose un emballage de fourrage qui examine la digestibilité NDF du fourrage; un paramètre qui est demandé par l'industrie. Le rendement en matière sèche en t/ha a été moyenné sur les trois répliques pour chacun des traitements d'espèces et de mélanges et une ANOVA a été réalisée entre les traitements.

Les traitements qui utilisaient au moins une certaine quantité de ray-grass annuel comme ou dans la culture compagnon avaient le rendement le plus élevé. Ce n'était pas prévu car le ray-grass annuel ne survit généralement pas à nos hivers. Cependant, il convient de noter qu'un ray-grass de type italien a été utilisé dans cet essai, qui dans les climats plus doux peutêtre semestriel. L'hiver 2020 a évidemment été assez doux pour qu'il survive. Rétrospectivement, les chercheurs auraient peutêtre dû utiliser un rye-grass de Westerwolds, une véritable espèce annuelle, pour cette application.

Le traitement de culture sans compagnon était le quatrième plus haut rendement, bien qu'il ne soit statistiquement différent d'aucun des autres. Il sera important de continuer à surveiller les parcelles au fil du temps pour voir quelles seront les implications à long terme de l'utilisation de cultures compagnons.

4. Évaluation d'urgence ou annuelle des cultures fourragères

Objectif

Évaluer la pertinence de nombreuses espèces végétales comme cultures fourragères d'urgence dans les fermes d'élevage du Nouveau-Brunswick.

Contexte: Une saison de croissance extrêmement sèche en 2018 et une mortalité hivernale généralisée en 2019 ont poussé les éleveurs du Nouveau-Brunswick à se démener pour trouver des options de culture qui leur fourniraient suffisamment de nourriture pour leurs animaux.

Des espèces annuelles, y compris l'ensilage de maïs, le millet perlé hybride, le sorgho-sudangrass, le sudangrass hybride, le ray-grass italien, le teff, l'avoine fourragère et les pois, le silobuster, le seigle d'automne et le soja fourrager, ont toutes été établies dans des parcelles répliquées sur le site de Knightville pour évaluer leur capacité à fournir une source d'alimentation à haut rendement et de haute qualité en une seule saison après des conditions de croissance difficiles. Les paramètres d'évaluation étaient le rendement humide, le rendement en matière sèche et de nombreux paramètres de qualité qui comprenaient un calcul du rendement laitier par hectare.

La digestibilité du fourrage, une demande d'analyse de l'industrie, faisait partie de l'analyse en laboratoire, ainsi que la qualité du fourrage et la matière sèche.

Sommaire

Des espèces fourragères annuelles potentielles et des mélanges ont été établis dans un RCBD. Les céréales d'hiver ont été plantées le 21 septembre 2020 pour la récolte au printemps 2021. Cela comprenait des céréales d'automne percées de seigle, des céréales d'automne diffusées de seigle, du triticale d'hiver et un mélange de seigle de céréales d'automne, de triticale d'hiver et de trèfle balansia. Les céréales de printemps et les mélanges de céréales ont été plantés le 24 mai 2020 et comprenaient de l'avoine, de l'avoine et des pois, du silobuster, de l'avoine, des pois et du ray-grass annuel. Les annuelles de la saison chaude ont été plantées le 14 juin 2021 et comprenaient un sorgho fourrager, de l'herbe BMR sorgho-soudan, du millet perlé fourrager canadien, du millet japonais, hybride, du millet perlé, du teff et un mélange sorgho-sudangrass qui comprenait du raygrass annuel, du trèfle rouge, du trèfle balansia, du trèfle berseem et du trèfle cramoisi. Un soja fourrager et du sarrasin ont également été plantés à cette époque.

Le sarrasin avait le rendement le plus bas de toutes les cultures plantées. En raison de la nature de la culture, une seule coupe constitue son total saisonnier. Cependant, il est important de noter qu'il était prêt à être récolté en un peu plus de trente jours, ce qui permet de multiples plantations en une seule saison. Les coûts associés aux semences et aux plantations multiples devraient être pris en compte pour déterminer si cela serait rentable. Dans les situations où une récolte rapide est nécessaire, le sarrasin pourrait convenir. La pertinence de toute culture est finalement déterminée par le système de production de fourrage disponible à la ferme.

Le soja fourrager avait le rendement le plus élevé de toutes les cultures plantées, bien qu'il ne soit pas statistiquement supérieur à plus de la moitié des options évaluées. En raison de la nature de la récolte, elle n'a été récoltée qu'une seule fois en septembre. 17. À cette fin de la saison de croissance, le flétrissement de cette quantité de biomasse peut s'avérer difficile à l'échelle de la ferme et devrait être pris en compte lors de la culture de cette culture.

Les paramètres de qualité du fourrage ont été évalués pour les première et deuxième boutures (le cas échéant). Seuls les résultats pour le rendement laitier par tonne (MPT) de fourrage de la première coupe sont rapportés ici (Figure 4). Lorsque le rendement en matière sèche et l'indice MPT sont combinés, une valeur de rendement laitier saisonnier par hectare peut être obtenue. Produire le plus de fourrage sur le moins de terres entraîne généralement le plus grand retour sur investissement. Cependant, selon le type d'animal nourri et l'opération spécifique, la qualité peut jouer un rôle plus important dans la sélection des cultures. La figure 5 indique le rendement laitier saisonnier pour toutes les cultures cultivées dans cet essai. Même si le sarrasin avait l'un des indices MPT les plus élevés, son faible rendement lui a valu le rendement laitier estimé le plus bas par hectare de toutes les cultures cultivées. Le rendement laitier estimé par hectare des autres cultures variait selon les espèces.

Enabling Agricultural Research and Innovation

Element 1, Innovative Research and Development Interim Report

1. *Project title and project number*: C1819-0246-Y4 NB Forage Variety Evaluation and Management Trials

2. *Project leader and collaborators*: The project team will include Ray Carmichael, NBSCIA General Manager, Zoshia Fraser, NBSCIA Assistant General Manager, NBSCIA Research Technician; Summer Research Assistant, Agro-Environmental club Agrologists; Pat Toner, Jason Wells and David Dykstra (NBDAAF).

3. *Specify period of time for which the interim report is being submitted:* April 1, 2021-Feb 12, 2022

4. *Project Objective(s):*
   To identify nutrient uptake and removal requirements of legume and grass forage stands at the higher forage yields being obtained and at medium fertility and pH levels.
   To evaluate the effect of species interaction of Red Clover and Alfalfa (the legumes) with grass species with the potential for higher quality and yield in both complex and simple forage mixtures over the life of a sward.
   To evaluate the role of annual forage species and cereals (oats, barley, peas, etc.) as a companion or nurse crop
   To evaluate numerous plant species for suitability as emergency forage crops on New Brunswick livestock farms.

5. *Project Deliverable(s):*
   Evaluation of New Brunswick's present fertility requirements of legume and grass forage crops at the higher forage yields being obtained and at medium fertility and pH levels. This will indicate if New Brunswick fertility recommendations need revisions to support the yields that producers are expected to achieve.

   Identification of the species interaction in both complex and simple forage mixtures over a production cycle. Red clover and alfalfa (legumes) and standard grass species as well as some of the newer grass species with the potential for higher quality and yield will be looked at.

   Evaluation of the comparative advantage of various annual forage species used as a companion or nurse crop in the establishment year and subsequent production years of alfalfa.

   Evaluation of the comparative advantage of various "emergency" annual forage species.

6. *Summary of Progress:*

   Plot Scale Assessment of Draft Legume Forage (Alfalfa) Fertility Recommendations
   To identify nutrient uptake and removal requirements of legume and grass forage stands at the higher forage yields being obtained and at medium fertility and pH levels

   Project leader and collaborators: Ray Carmichael (NBSCIA) and Pat Toner, Jason Wells and David Dykstra (NBDAAF).

   Specify period: April 1, 2021-Feb 11, 2022

Project Objective(s): To determine how well alfalfa yield would respond to a new fertilizer recommendation for increased levels of potassium.

Project Deliverable(s): A yield-based trial for various fertilizer scenarios comparing K_2O additions to removal.

Summary of Progress: The forage research site was relocated to Knightville, NB in the spring of 2020. Due to Covid-19, work at the site was delayed, but an area did get planted to a straight alfalfa stand so that fertilizer treatments could be imposed in the spring of 2021. The planted alfalfa did establish reasonably well despite the drought like conditions in 2020 and was deemed suitable to continue this work.

Testing of alfalfa response to potassium was conducted at two different locations in 2019 Richmond Corner and 2021 Knightville using replicated randomized block designs. Potassium soil lest levels at these two sites were 108 M+ ppm and 84 M+ ppm respectively at the beginning of the seasons. These would require fertilizer rates of 68 kg/K2O/ha under our traditional NB recommendations and 110 kg/K2O/ha under proposed ones. A range of fertilizer rates were applied either side of old and proposed recommendation rates in both years with a broader treatment range and follow up soil testing in Knightville. A summary of the potassium applied, and uptake seen across all cuts in both seasons in shown in Table 1. 2019 results would imply no differences cut to cut, were as the season total appears to increase with higher rate of potassium. In 2021 to fine tune this a broader range of treatments was used. The yield appeared to be higher in the treatment that applied 127 kg/k/ha (approximately 150 kg/K2O/ha) in the first cut. Upon further in season soil testing using a composite of the plots by treatment, that treatment had significantly higher soil test levels of potassium at 170 ppm of K or well over the H+ level of 148 ppm, all others being M+. This may have resulted in a higher yield for the first cut. It does identify a need to soil test each plot for soil potassium when forage yield and tissue sampling are taken. In that way, a more thorough assessment of nutrients can be made across fertilizer treatments to see if an increased rate of potassium is justified.

Table 1. Yield and K Uptake Data

Trts	2019 RC dmb Yld T/ha					Trts	2021 FJ dmb Yld T/ha		
kg/k/ha	17-Jun-19	17-Jul-19	27-Aug-19	Season		kg/k/ha	11-Jun-21	10-Aug-21	Season
0	3.2 A	2.1 A	1.2 A	6.5 A		0	5.1 AB	3.5 A	8.7 A
125	3.1 A	2.3 A	1.2 A	6.6 AB		42	4.8 A	3.5 A	8.3 A
250	3.5 A	2.6 A	1.2 A	7.3 B		84	4.8 A	3.3 A	8.2 A
P - Value	0.065	0.059	0.956	0.035		127	5.6 B	3.3 A	8.9 A
						169	5.1 AB	3.3 A	8.4 A
						P - Value	0.024	0.679	0.114
Trts	2019 RC Uptake kg/k/ha					Trts	2021 FJ Uptake kg/k/ha		
kg/k/ha	17-Jun-19	17-Jul-19	27-Aug-19	Season		kg/k/ha	11-Jun-21	10-Aug-21	Season
0	40 A	48 A	17 A	104 A		0	129 A	67 A	196 A
125	47 A	63 A	17 A	127 A		42	119 A	68 A	188 A
250	61 A	59 A	20 A	139 A		84	119 A	66 A	185 A
P - Value	0.451	0.66	0.375	0.286		127	135 A	68 A	204 A
						169	127 A	68 A	194 A
						P - Value	0.392	0.990	0.498
To convert Trt Kg/k/ha to kg/k2O/ha * 1.2									

GRASSES LEGUME MIXTURE EVALUATION

To evaluate the effect of species interaction of Red Clover and Alfalfa (the legumes) with grass species with the potential for higher quality and yield in both complex and simple forage mixtures over the life of a sward.

Complex forage mixtures sometimes containing a couple of legume species and more species of grasses are being promoted by sales persons in New Brunswick. Meanwhile forage researchers, such as Dr. Dan Undersander at UW and Dr Gerry Cherney at Cornell University are recommending simpler mixtures containing a legume and one or two grass species.

Summary of Progress

The exceptionally dry climactic conditions at the Richmond Corner site during the 2019 growing season had a negative impact on establishment for all mixtures and species. Since most of the forage work was being moved to a new site in Knightville, NB in 2020, these plots were abandoned. The Covid-19 pandemic created numerous challenges with the establishment of the new forage site. It was not possible to properly prepare the site to accommodate perennial forage mixtures containing alfalfa (i.e. alfalfa autoxicity). The focus was placed on other components of this project that were able to be established and bring useable info to producers in a timely fashion.

NURSE OR COMPANION FORAGE CROP EVALUATION

To evaluate the role of annual forage species and cereals (oats, barley, peas, etc.) as a companion or nurse crop

The use of a cereal crop as a companion/nurse crop (referred to as companion crop from this point forward) has been a long-standing practice on many livestock farms in New Brunswick. The idea behind this practice is that the cereal crop competes with weeds early in the growing season and ensures that a decent crop is realized in the establishment year. Some farms would harvest the cereal crop as mature grain and take the straw for use as bedding. Other farms opt to take the cereal crop as silage and depending on the year take a subsequent cut of forage in mid-August. This system can penalize forage production the following year when the cereal crop lodges, grain harvest and/or silage harvest is later than desired for the forage crop to get satisfactory growth going into winter or the cereal crop is seeded at too high a rate. Farms have moved away from the traditional oat or barley companion crops, to using cereal/pea mixtures, annual ryegrass and even Sudangrass being suggested lately.

Alfalfa was seeded alone and in combination with various companion crop options (Table 2). The dry climactic conditions during the 2020 growing season impacted the establishment and performance of all combinations, but fortunately establishment was satisfactory and trial work could continue in 2021.

Table 2. Companion Crop Plot Layout and Seeding Rates

Rep 1		Rep 2		Rep 3
Guard		Guard		Guard
Medium Oats/Peas (80kg/ha)		Low Sudangrass (15kg/ha)		Medium Oats/Peas (80kg/ha)
No Companion Crop		High Sudangrass (20kg/ha)		High Sudangrass (20kg/ha)
Low Ryegrass + Low Oats/Peas (5kg/ha + 55kg/ha)		Medium Oats (80kg/ha)		High Oats (135kg/ha)
Low Oats/Peas (55kg/ha)		Low Ryegrass (5kg/ha)		Low Ryegrass + Low Oats/Peas (5kg/ha + 55kg/ha)
High Oats/Peas (160kg/ha)	Pathway	Medium Oats/Peas (80kg/ha)	Pathway	Low Oats (55kg/ha)
Low Ryegrass (5kg/ha)		High Ryegrass (10kg/ha)		Low Sudangrass (15kg/ha)
Low Oats (55kg/ha)		Low Oats (55kg/ha)		Low Ryegrass (5kg/ha)
Low Sudangrass (15kg/ha)		No Companion Crop		Medium Oats (80kg/ha)
High Sudangrass (20kg/ha)		Low Oats/Peas (55kg/ha)		High Ryegrass (10kg/ha)
High Oats (135kg/ha)		High Oats/Peas (160kg/ha)		High Oats/Peas (160kg/ha)
Medium Oats (80kg/ha)		High Oats (135kg/ha)		Low Oats/Peas (55kg/ha)
High Ryegrass (10kg/ha)		Low Ryegrass + Low Oats/Peas (5kg/ha + 55kg/ha)		No Companion Crop
Guard		Guard		Guard

The establishment of the alfalfa was evaluated in the spring of 2021, by counting the number of plants in a $0.25m^2$ quadrate. It is evident from Figure 1 that more alfalfa plants were present when alfalfa was planted alone (no companion crop). The number of alfalfa plants in plots that had used either a low rate of oats or a low rate of oats and peas as the companion crop were less than the no companion crop treatment but were not statistically different from it. Only the no companion crop treatment and the low oat treatment had the required number of plants needed to be considered a healthy first production year stand (32-54 plants/$0.25m^2$).

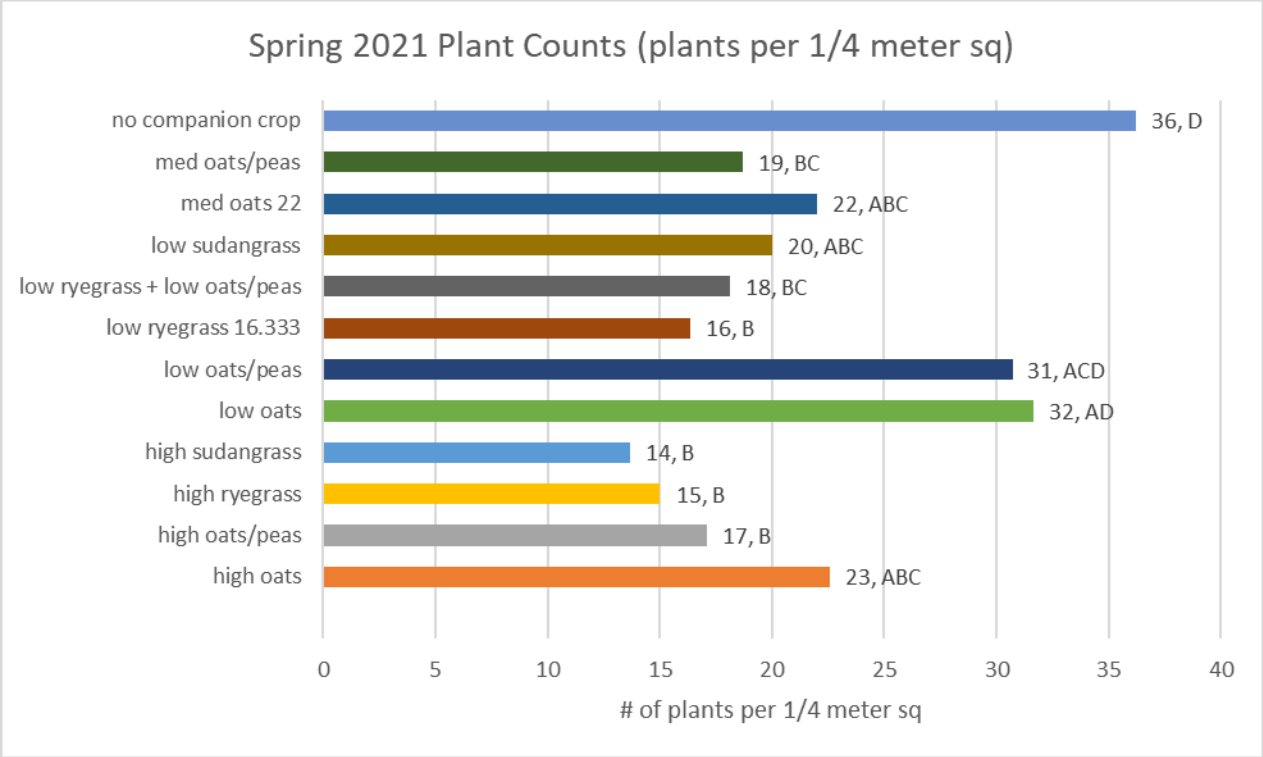

Figure 1. Alfalfa Plant Counts in the Spring of 2021

Yields of the treatments in the first production year (2021) was quantified. Samples were taken from the Hauldrop harvester for analysis at A&L Labs for forage quality and dry matter. This lab was chosen, because it offers a forage package that looks at the NDF digestibility of the forage; a parameter that is being requested by the industry. Dry matter yield in t/ha was averaged across the three replicates for each of the species and mixture treatments and an ANOVA were conducted between treatments.

Yield results are graphically represented in Figure 2. Treatments that used at least some amount of annual ryegrass as or in the companion crop had the highest yield. This was not expected as annual ryegrass generally does not survive our winters. However, it should be noted that an Italian type ryegrass was used in this trial, which in more milder climates can be a biannual. The winter of 2020 was obviously mild enough for it to survive. In retrospect, the investigators should maybe have used a Westerwolds ryegrass, a true annual species, for this application.

The no companion crop treatment was the fourth highest yielding, although not statistically different from any of the others. It will be important to continue to monitor plots over time to see what the long-term implications of using companion crops will be.

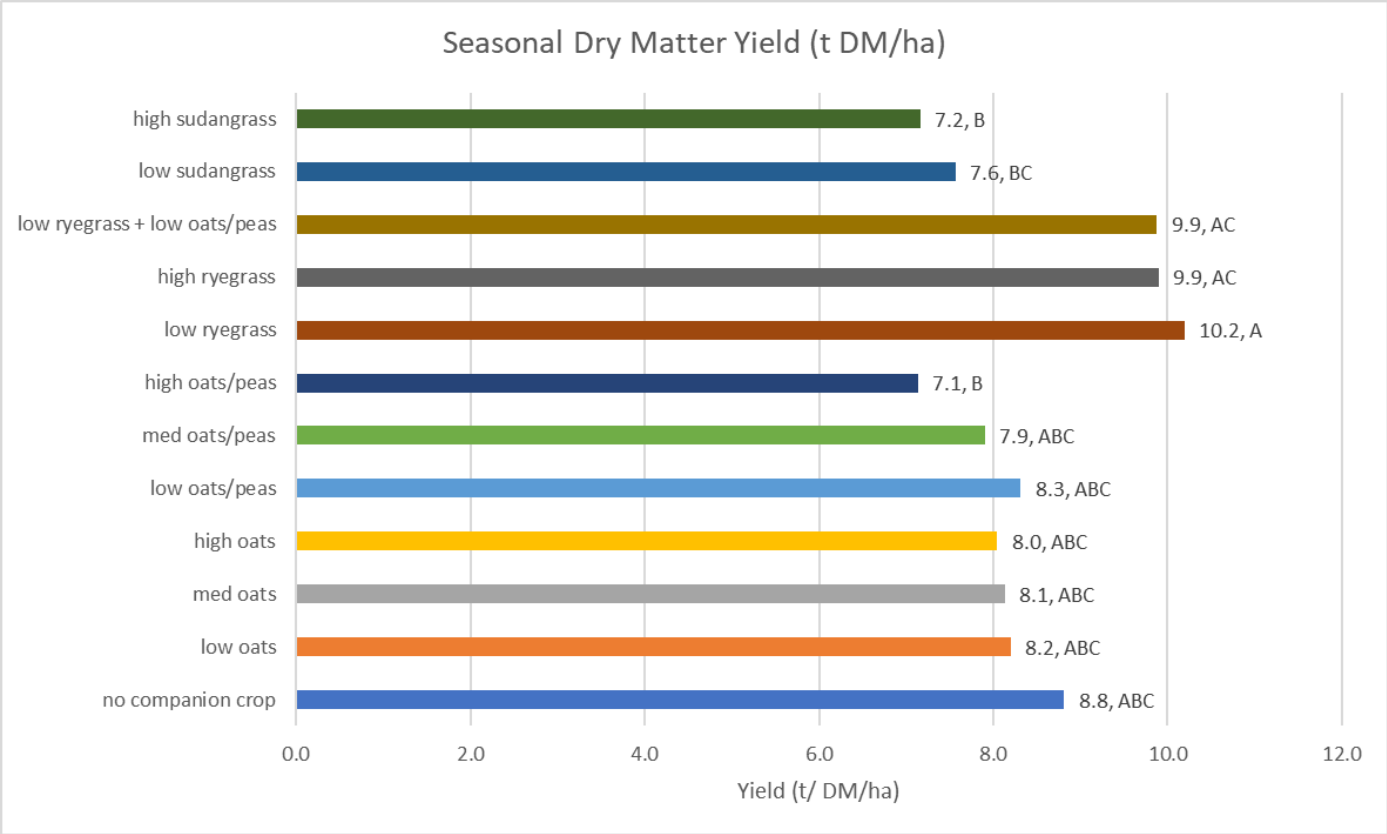

Figure 2. Seasonal Dry Matter Yield (t/ha)

EMERGENCY or ANNUAL FORAGE CROP EVALUATION

Management of annual crops or mixtures to re-establish winter failure or compensate for drought and weather extremes caused by global warming will become critical to NB livestock producers.

An extremely dry growing season in 2018 and widespread winter kill in 2019 left NB livestock producers scrambling to find crop options that would provide them enough feed for their animals. Annual species including corn silage, hybrid pearl millet, sorghum-sudangrass, hybrid sudangrass, Italian ryegrass, teff, forage oats and peas, silobuster, fall rye and forage soybeans were all established in replicated plots at the Knightville site to assess their ability to provide a high-yielding and high-quality source of feed in a single season following challenging growing conditions. The parameters of evaluation were wet yield, dry matter yield and numerous quality parameters which included a calculation for milk yield per hectare.

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Summary of Progress

Potential annual forage species and mixtures were established in a RCBD. Winter cereals were planted September 21, 2020 for harvest in the spring of 2021. This included fall cereal rye drilled, fall cereal rye

broadcast, winter triticale and a mix of fall cereal rye, winter triticale and balansia clover. Spring cereals and cereal mixes were planted May 24, 2020 and these included oats, oats and peas, silobuster, oats, peas and annual ryegrass. Warm season annuals were planted June 14, 2021 and included a forage sorghum, BMR sorghum-sudan grass, Canadian forage pearl millet, Japanese millet, hybrid, pearl millet, teff and a sorghum-sudangrass mix which included annual ryegrass, red clover, balansia clover, berseem clover and crimson clover. A forage soybean and buckwheat were planted at this time too.

Figure 3 illustrates the differences in seasonal dry matter yield per hectare between the crops. Statistical significance is indicated on the figure by letters. Depending on crop, the seasonal yield could be multiple cuts added together to produce the seasonal total.

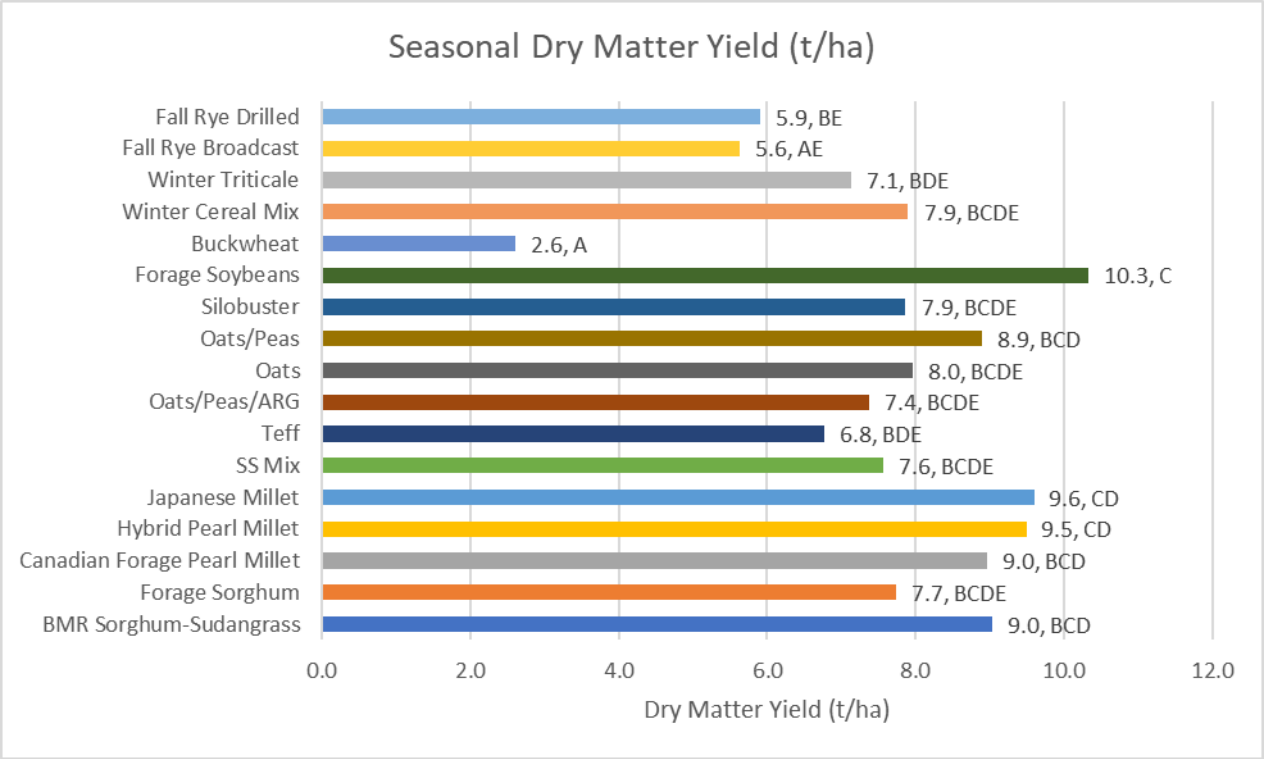

Figure 3. Season Dry Matter Yield (t/ha)

Buckwheat had the lowest yield of all the crops planted. Due to the nature of the crop, only one cut makes up its seasonal total. However, it is important to note that it was ready to be harvested in just over thirty days, making multiple plantings in a single season possible; the costs associated with seed and multiple plantings would need to be considered to determine if this would be cost effective. In situations where a quick crop is needed, buckwheat could fit. The suitability of any crop is ultimately determined by the forage production system available on the farm.

Forage Soybeans had the highest yield of all the crops planted, although not statistically higher than over half of the options that were evaluated. Due to the nature of the crop, it was harvest only once on September 17. At this late in the growing season, wilting of this amount of biomass may prove challenging on a farm scale and would need to be considered when growing this crop.

Forage quality parameters were assessed for first and second (if applicable) cuttings. Only the results for milk yield per tonne (MPT) of forage of the first cutting are reported here (Figure 4). This MPT index was introduced by Undersander et al. (1993) and uses forage analyses (crude protein, NDF, *in vitro* NDF digestibility, and non-

fiber carbohydrate) to estimate energy content using a modification of the NRC (2001) summative approach and DM intake from NDF (Mertens, 1987) and *in vitro* NDF digestibility (Oba and Allen, 1999) to predict milk production per tonne of forage DM.

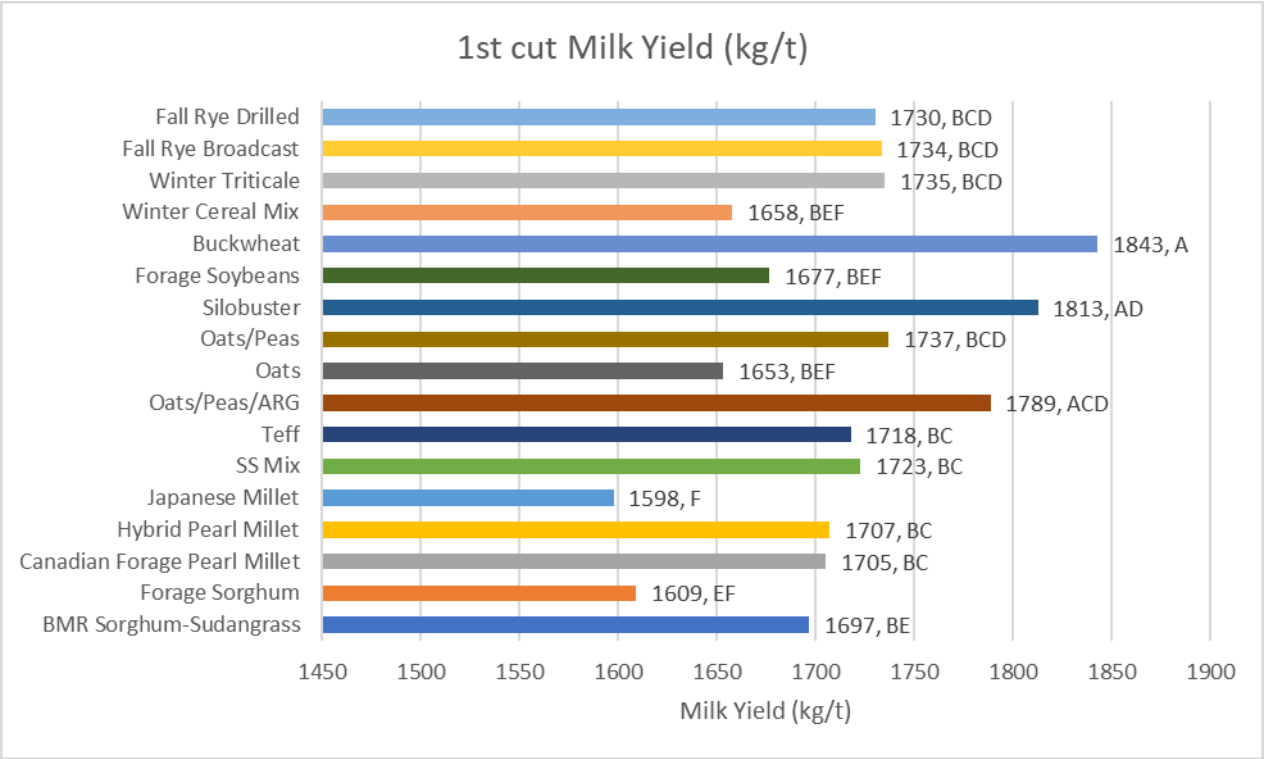

Figure 4. First Cut Milk Per Tonne

The MPT index for the four winter cereal options were not statistically different from one another. The winter cereal mix was slightly lower than the others but is believed to be due to the maturity differences between fall rye and winter triticale. Cutting time for this treatment was determined by the maturity of the winter triticale, which meant that the fall rye component of the winter cereal mix treatment had been fully headed for approximately one week. Harvesting cereal grains as forage at this stage of maturity is known to result in lower forage quality and may have resulted in this treatment having a lower MPT index.

The cool season annual forages all varied in their MPT index, with some being influenced by their maturity at harvest. Temperatures well above average at the first of June caused most of the cereal crops to head out earlier than the normal 55-60 days. This created conflicts with harvest schedules and resulted in some of these treatments not being harvested until they were over mature for quality forage. Oats appeared to be impacted the most by this.

The warm season annual forages, except for the forage sorghum, were harvested before seed heads emerged. The Japanese millet had a statistically lower MPT index than the other five crop options in this group. It is unknow if this is a characteristic of this type of millet or if some other factors influenced its lower feed quality.

When dry matter yield and the MPT index are combined, a seasonal milk yield per hectare value can be obtained. Producing the most forage on the least land usually results in the largest return on investment. However, depending on what type of animal is being fed and the specific operation, quality may play a larger part of crop selection. Figure 5 reports the seasonal milk yield for all the crops grown in this trial. Even though buckwheat had one of the highest MPT indexes, its low yield resulted in it showing the lowest estimated milk

yield per hectare of all the crops grown. Estimated milk yield per hectare of the other crops varied between species.

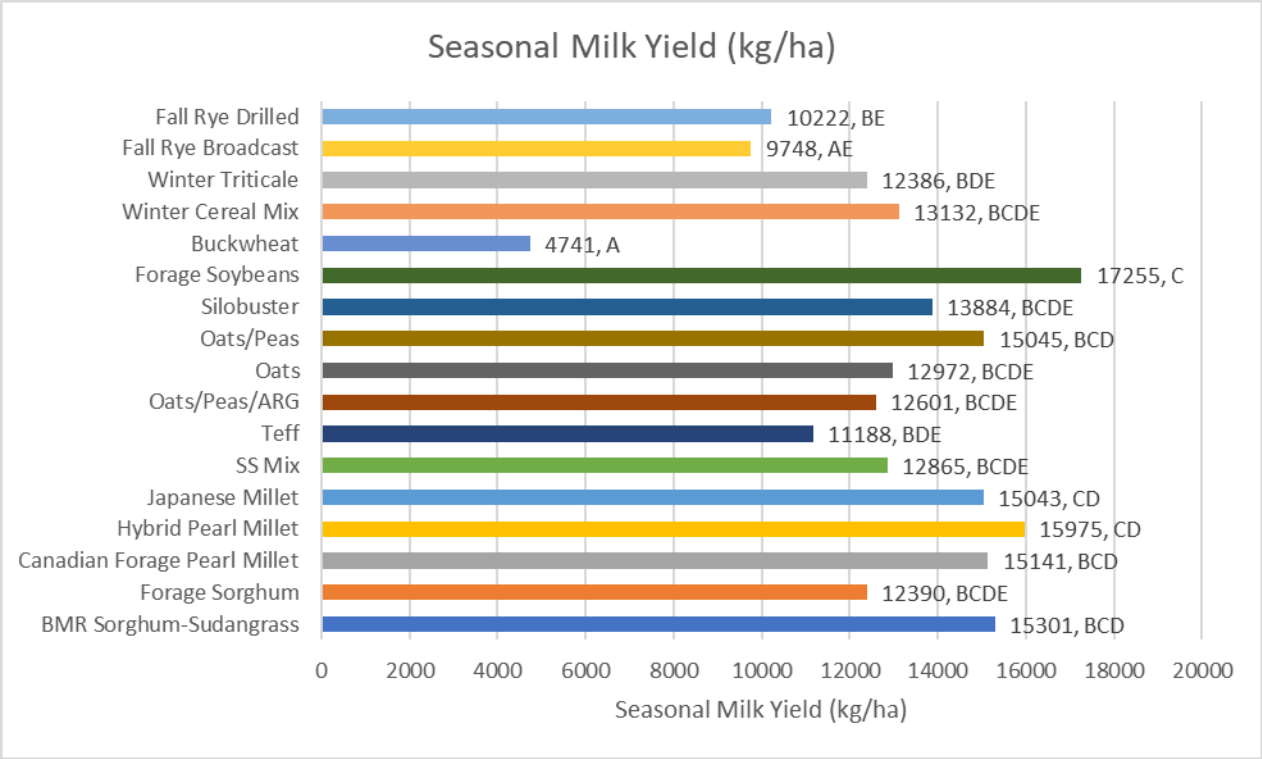

Figure 5. Seasonal Milk Yield per Hectare

Adjustments: no adjustments are needed.