Peace Country Cocktail Cover Crop Guide:

A Complete Guide to Growing Cocktail Cover Crops for Forage in the Alberta Peace Region

PCBFA
PEACE COUNTRY BEEF & FORAGE ASSOCIATION
APPLIED RESEARCH

"Strengthening Agriculture, One Farm at a Time"

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Preface & Acknowledgements

Preface:
The Peace Country Beef & Forage Association (PCBFA) Cocktail Cover Crop Guide and the recommendations within are based upon applied research and extension activities conducted across the Alberta Peace Region by PCBFA, and from studies conducted elsewhere in Canada & the USA. In the future, this guide will be revised and updated with more relevant information as it is researched and becomes available.

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Introduction

Introduction

There has been ever increasing interest and excitement around cocktail cover crops in the Peace Country over the past few years. There are producers in the region who have been successfully using cocktail cover crops as a way to produce high quality forages for grazing, silage and swath grazing.

PCBFA's Cocktail Cover Crop Tour, August 9th, 2018 stop at M4 Ranch near Fairview, Alberta. Photo: PCBFA

Studies that have been completed in the Peace, as well as across western Canada have shown that multi-species annual mixtures can consistently have a great potential to produce remarkably higher forage yield than mono-crop annual forages such as barley or oats. In addition, the forage quality of cocktail mixes can consistently also surpass the quality of mono-crop annual forages.

There are a number of benefits beyond feed quality and yield that we can reap from planting cover crops - most notably, improved soil health. Benefits to our soils include but are not limited to: breaking up soil compaction, capturing and increasing soil available nutrients, improved water infiltration rates, higher soil organic matter, increasing soil biology biodiversity, and providing ground cover. Therefore, if you are interested in growing your own cocktail cover crop, it is important to understand some of the basics of the soil beneath our feet.

Soil Health

When we think about what's under our feet, what comes to mind? Dirt? Asphalt? Soil? It has been said that the soil beneath our feet is far more than just dirt, but it supports and drives all of life on earth. So when we think about how to manage production on our farms and ranches, our soil should be the first thing that comes to mind - it is a living, breathing thing! Soil is not an industrial commodity, and if not taken care of, it can be "used up." Soil is an ecosystem that we can learn about and work with to have healthy and productive land with minimal inputs.

When we think of our soil as an ecosystem, soil health can become very intimidating, very quickly. There are many experts who have dedicated their entire lives to studying our soils and the biology in them, and there is still so much to learn. Luckily, experts in soil biology and soil health can agree that there are 5 main principles that producers can follow when making management decisions:

The Principles of Soil Health

1: Keep the Soil Covered.

Having armor on the soil and keeping it covered helps protect it from factors such as wind and water erosion, evaporation and compaction from heavy rainfall. It helps to moderate soil temperature, supports beneficial soil biology and suppresses weed growth.

2: Minimize soil disturbance

Soil Health

A healthy soil has a structure to it, with pore spaces and soil aggregates, giving it a chocolate cake-like appearance. Water and air are stored in the pore spaces, which are also the home of soil biology - including mycorrhizal fungi, a highly beneficial species. Mycorrhizal fungi produce root-like extensions called hyphae, which take up water and soil nutrients that would otherwise be unavailable and make them available to plants. Glomalin, the 'glue' that holds the soil together and forms soil aggregates, is also formed on the hyphae, giving soil more resilience to disturbances and weather extremes. Soil that is regularly disturbed will have lower levels of glomalin; as well, soil aggregates and pore spaces are easily destroyed by disturbances. Soil organic matter is the powerhouse of our soil, and provides soil structure, resilience to weather extremes, and improved nutrient availability. Disturbances such as tillage deplete soil organic matter, causing it to decompose faster by exposing more surface area to oxygen and warming and drying the soil. This leads to increased water and wind erosion, reduced water infiltration rates, and increased compaction.

3: Plant Diversity

Our soil and plant ecosystems were designed to include a diversity of plants. A diverse mix of plants helps to maximize the amount of carbon going into the soil from the air and this soil carbon feeds our beneficial soil biology. To add plant diversity to our annual crop management, we can lengthen our crop rotations to at least 3-4 years, or ideally, add in intercropping and cocktail cover crops. In a growing season, we can aim to include cool and warm season plants, grasses and broadleaves, legumes and forbs, which all have unique characteristics including below ground with their root systems. Diversity above ground means diversity below ground in our microbial populations, which will lead to more productive and resilient soils.

Soil Health Principles infographic from Understanding Ag LLC https://understandingag.com/resources/fact-sheets/

4: Keep Living Roots in the Soil

Keeping a living root in the soil supports the beneficial biology in the soil: soil biology needs a living root to thrive. The carbon provided to the soil from plants above ground supports the microbial activity in the soil. This increased activity by soil microbes can improve soil structure, increase nutrient availability and improve infiltration and water-holding capacity. If we can keep living, growing roots in the soil from the very beginning of the growing season, to the last frost or snowfall that ends the Peace Country growing season, we

are maximizing our carbon input and keeping our below ground livestock fed.

5: Livestock Integration
Animals have always been a part of our natural landscapes, and when managed properly, can greatly improve soil health. Soil health guru Jay Fuhrer states that "livestock convert high-carbon material to low-carbon material that feeds the soil biology and soil food web." Livestock help to cycle nutrients and well-managed grazing can help to manage weed pressure and bring about improved forage production. Cocktail cover crops offer a great option for feeding cattle, providing a high quality feed and improving the soil at the same time.


Cattle grazing a standing cocktail cover crop in the fall near Teepee Creek, AB. Photo: Ken Binks

A Sixth Principle of Soil Health: Context
Effective soil management goes beyond just the physical management, but also an awareness of the other aspects of farm and ranch management, which includes financial and people resources. The Noble Research Institute describes knowing your context as a farmer or rancher knowing “their individual situation- climate geography, resources, skills, family dynamics goals, and other factors that influence themselves and their operations. They know what’s available to them to work with and they apply the soil health principles in ways that align with and make the most of what they have for the benefit of the land, their profitability and their quality of life.”

History of Our Peace Region Soils

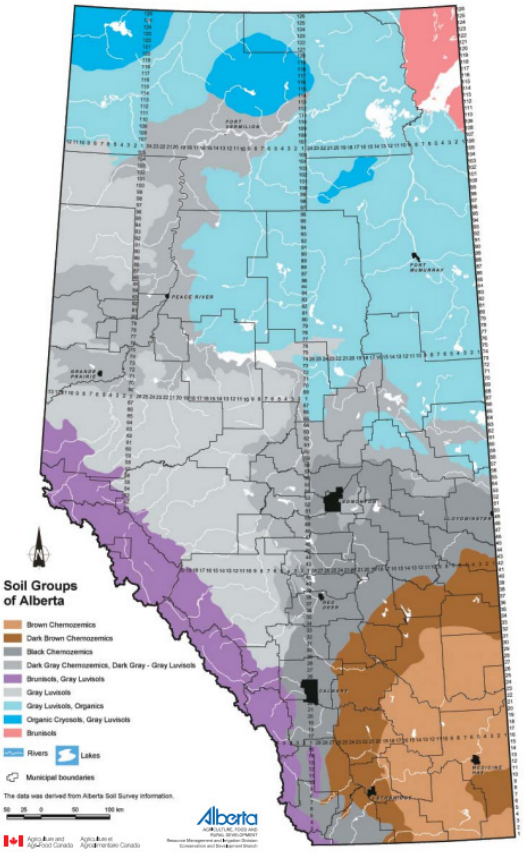
How were these soil health principles determined? To look deeper into that, we need to look back to our soil’s natural state prior to human disruption back when our soils were managed by nature.

Our landscape in the Peace Region prior to the introduction of agriculture and mass settling, was a mixture of various native, perennial grasses, legumes, forbs, and trees, that saw herds of wild herbivores such as bison grazing and moving across the region in random patterns. When we think of this system, all five principles of soil health are at play: the soil was always covered, there was minimal soil disturbance, there was a wide variety of native species, meaning that there was diversity of species above ground and a variety of roots below ground, and native plant communities almost always have a living root in the soil. Native species have a cycle that matches the natural climatic conditions, meaning that frost-free days are maximized, and many species are cold tolerant. The large number of herbivores that crossed the landscape, followed by predators which kept them moving allowed grazing disturbances to happen, and without fences to contain grazers, the land was given sufficient time to rest and recover before it was grazed and disturbed again. When the great herds took too long to come back to places, nature would take care of overgrowth with wildfire, which would inject carbon into the soil in the absence of grazing.

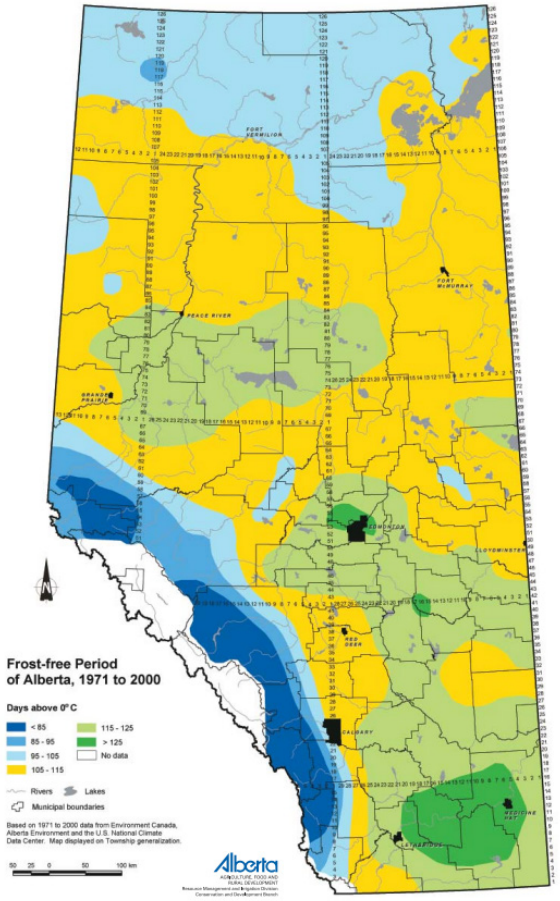
There are three main soil types in the Peace Region that exist based on the natural conditions of the landscape. According to extensive research done on the history of the Peace River Region by Dr. Robert Irwin, the native landscape included:

1. Prairie areas, including near Grande Prairie, Spirit River and Fairview, which had mainly highly productive black soils which were high in nutrients
2. Next to these prairie areas was land consisting of light bush and scrub with grey-wooded transitional soils of lower nutrient content
3. Grey-wooded soils cover nearly 80% of the Peace River region; these soils were formed under bushland with thin top soil and few nutrients. These soils were also found to be very acidic, as a result of decaying pine needles and leaves, a characteristic that Peace Country producers still contend with today.

During settlement of the Peace in the early 1900's, the Peace River Region was described in one pamphlet: "Extremes of temperature, sudden changes and severe storms are very rare. The winters, while not classified as mild, are very dry, with clear skies, little snowfall, and few winds. Blizzards are unknown!" We all know now to take that description with a grain of salt. Frost free days in the Peace Region averages 80-120 days depending on location. Blizzards are very real here, as approximately half of total annual precipitation in the area comes as snow.



Soil Groups of Alberta. From Alberta Agriculture, Food & Rural Development's Land Resource Atlas of Alberta, 2nd Edition, pg.15 (2005)



Average Frost-Free Days in Alberta from 1971-2000. From Alberta Agriculture, Food & Rural Development's Land Resource Atlas of Alberta, 2nd Edition, pg.8

What is a Cocktail Cover Crop?

What is a Cocktail Cover Crop?

According to the Merriam-Webster dictionary, a cover crop is defined as: “a crop planted to prevent soil erosion and provide humus.” Cover crops are typically crops seeded with the intent to “cover” the soil and improve soil rather than for the purpose of being harvested. A cocktail cover crop is a multi-species mix of plants that could include annual grasses, broadleaves and legume species seeded in a blend to provide multiple benefits.

This cover crop definition fits for our neighbours to the south who have longer growing seasons, and who seed covers after combining and then terminate the crop prior to seeding the next cash crop. When we think about the context in the Peace Country, some years we are lucky to even get the crop off, let alone have to worry about seeding something to cover the soil. Therefore, cover crops in the Peace Country don’t always fit this traditional definition. In the Peace, a multi-species mix of four or more different annual crops, grown over a full-season, and usually for livestock feed is commonly considered a cocktail cover crop, and that is the focus of this manual. PCBFA and other research organizations in the Peace are continuing work on the application of cocktail cover crops in the context of annual grain farming operations.

"A cocktail cover crop for me, and for the Peace Country, is a polyculture of species grown together to try to diversify the root system. We're trying to create a multitude of roots so that we can get some organic matter and fiber back in the soil. In other areas where you get a longer growing season, they are seeding cover crops, and that makes sense, because they are actually using them as cover between crops. Unfortunately in the Peace Country, we only have one crop."

- Ken Binks
Teepee Creek, AB

"Typically where you have these long growing seasons, you grow a cover crop in between your cash crops. But we're trying to utilize cocktails in the form of biological primers for the soil. We're growing these multispecies cover crops to build up our soil health versus the typical practice of putting in a monoculture, throwing some fertilizer at it, and hoping for rain."

- Robbie Hale
Hines Creek, AB

Cocktails can be a practical, annual application of natural ecological principles that our soil was built on, otherwise known as biomimicry. As noted previously, our soils were built by a very diverse set of native, perennial plants. This land at one time had a vast biodiversity of organisms, where plants interacted with each other in a beneficial manner, carbon was sequestered in the soil by animal impact or wildfire, and there was habitat for beneficial insects, and larger native species.

In the Peace Region, cocktail cover crops are being successfully used by producers for:

- Swath grazing
- Annual grazing
- Stockpiled grazing
- Silage and baleage, with regrowth often grazed
- Greenfeed
- Companion crops with an annual grain crop where residue is grazed and the companion crop improves the feed quality of the residue

"With a diverse cover crop all roots are crossing over below the soil surface touching each other and they are sharing things. If the crop combination is compatible, they are sharing nutrients and water. That is probably why a mixed species stand survives and does much better than a single species stand."

- Dr. Jill Clapperton

Benefits of Cocktail Cover Crops

The Benefits of Cocktail Cover Crops

There are many tools and ways to improve and take care of our soil in a way that reflects nature, and a cocktail cover crop is one of them. By attempting to imitate nature with annual crops, cocktails have the potential to increase forage production, improve water and soil quality, and increase nutrient cycling, moisture conservation, and crop productivity, all while sequestering carbon.

Setting Farm Goals

Setting Goals for Your Cocktail Cover Crop

When deciding if growing a cocktail cover crop is a good fit for your farm or ranch, the first step is to define what your goals are for the crop. Cocktails have been very popular as of late and many in the Peace Country and other regions have had great successes, but it's important to evaluate if it is a tool that is right for you. The idea of mimicking nature on our farms and ranches is often associated with improved soil health and production systems, however, we are managing an agroecosystem with the goal of producing food and having profitable operations, so making decisions with both goals in mind is beneficial to long-term viability.

Photo: Curt Hale, Hines Creek, AB

It is important to note that in terms of soil health, there is no better way to improve soil health than a diverse perennial pasture that is managed in reflection of the principles of soil health. With that in mind, cocktail cover crops may not be a fit for every farm.

Setting Farm Goals

When planning to seed a cover crop, goal setting is a very important step to success, yet is one of the most overlooked steps. To properly determine a good cover crop mix for the needs of a farm, it is important to determine short and long term goals.

A goal is defined by Merriam-Webster as "something that you are trying to do or achieve". Goals can be short-term and long-term, monetary, tangible or intangible, etc. Goal setting is important for all individuals and families, however, it is especially important for farm families due to the interconnectedness of family and the farm business. It is important to ensure that your goals are achievable, which requires some creative thinking; your farm's goals are unique to you and your situation, and you know your farm best. They will reflect the beliefs and values of your operation, the resources that are available to you, as well as the opportunities and limitations that you face. Achievable goals are also goals that require the cooperation of everyone involved in the farming operation. If someone is not in agreement with the set of goals, it will limit your ability to achieve those goals.

There are seven commonly accepted steps for setting achievable goals:

1. Assess where your farm was in the past
2. Assess your farm's resources and restrictions
3. Develop a general management plan
4. Identify and establish specific goals or objectives
5. Prioritize goals
6. Develop plans for action and implementing goals
7. Measure progress and reassess goals

These steps are meant to look at the farming business as a whole, in a holistic manner. These steps will include all considerations such as production goals, monetary goals, family goals, personal goals, etc. There are a number of worksheets available to work through your farm goals. An example of a goal setting worksheet can be seen below.

Goal Setting Worksheet

❑ Short-term ❑ Intermediate-term ❑ Long-term ❑ Farm/Business ❑ Family/Personal

Goals	Priority (High, Med., Low)	Potential Conflicts or Restrictions	Ways to Resolve Conflict	Resources Needed	Assigned Person(s)	Deadline
Most important goal?						
Second most important goal?						
Other goals?						

AGEC-244-2

Example Goal Setting Worksheet from Oklahoma State University's Extension Department. https://extension.okstate.edu/fact-sheets/images/goal-setting-for-farm-and-ranch-families/goal-setting-worksheet.pdf

To set achievable goals, it is important that your individual goals are SMART. SMART stands for Specific, Measurable, Action-oriented, Reasonable, and established in a Time frame. When defining goals, they need to be specific about what you want to achieve. To be specific - think the 'W' questions: who will do this action, what will the action be, when will it take place, where will it take place, and how will it be done? Reasonable goals should be challenging, but achievable, with timelines and actions that can be written down, and progress tracked.

Common pitfallls to goal setting include:

- Making goals too lofty
- Trying to do too many things at once
- Overemphasizing some aspects over others
- Vulnerability to unexpected events
- Failing to use all information or include all decision makers
- Ignoring good plans

Talking Cocktail Cover Crop Goals with Nicole Masters at Preston Basnett's near Eureka River, AB, June 2016. Photo: PCBFA

Setting Goals for Your Cocktail Cover Crop

Is a Cocktail Cover Crop a Tool That Can Help Meet My Farm Goals?

When we look at cocktail cover crop mixes and management, there is no silver bullet solution that will work for all producers and in all situations. Just because a mixture worked for your neighbour does not necessarily mean it will work on your farm. A cocktail cover crop is a tool that can be used to achieve goals and to provide services specific to your farm or ranch and even specific to one field or area on an operation. To determine the mixture that is going to work best for your farm and needs, you first need to determine your goals for seeding a cocktail cover crop, and identify the top 2-3 desired services you'd like it to provide. These goals or services could include:

> *"We are trying to grow as much feed as we can on a limited landbase, and cocktails are the way that we are achieving that goal. Originally, improved soil health was a side-effect. Some of those side-effects have become bigger goals. It is really cool to see all the different pollinators, it is neat to go out into a field and just hear it buzzing. Another big one for us is improving our water infiltration. We had some perennial sloughs, that now the water is going into the ground instead of sitting there."*
>
> *- Allan McLachlan*
> *Dunvegan, AB*

- Producing high quality feed, either grazed or stored
- Producing a high yielding forage crop
- Extending the grazing season
- Erosion control
- Improving soil health and fertility, including:
    - Improved water infiltration, boosting soil biology, weed suppression and keeping a living root in the soil

> *"What we are trying to do is extend our grazing season, and diversify our feedstock. Instead of growing a monoculture of barley or oats, and using it for greenfeed or silage, we are trying to create a ration, and grow a ration rather than having to find supplementation for the monocrop. The cocktail mixes allow us to adjust protein and energy in the seedbox of the drill"*
>
> *- Ken Binks*
> *Teepee Creek, AB*

Going through a gross profit analysis of what it will cost and what the return will be to grow a cocktail cover crop is a key step in deciding if it's going to be an effective tool. When choosing a mixture, the cost of each species is an important part of figuring out the costs, as some species can be very pricey, and can be substituted with a less expensive species, if you know what your goals and profit margins are.

A useful decision making process often used in Holistic Management is a good exercise to go through to decide if a cocktail cover crop is a good fit and includes the following steps:

1. Root cause: does putting in a cocktail cover crop address the root cause of a problem or challenge? This helps to not just address symptoms.
2. What are the weak links on your farm or ranch: financial, social and biological? Does a cocktail cover crop strengthen any of the weak areas?
3. Comparing options: does a cocktail cover crop provide the greatest return for the time and money that will be spent compared to other options? Quantify options in terms of $/hour and return per dollar invested. Also consider available resources such as the right equipment to do the job.
4. Gross profit analysis: what will the cost be and what will be the return to grow a cocktail cover

Regrowth on a cocktail mix a week after silage harvest. August 2020, Photo: Allan McLachlan, Fairview, AB

crop? This includes just the direct costs and revenue, no overhead costs.

5. Input analysis: what is the source of money or energy that will be used to put in and manage a cocktail cover crop? Is borrowed money needed? Is this a one-time use of money, and is the energy source to be used renewable? If a cocktail will be grazed, for example, manure will be left behind the following year and fertility requirements will be lower, adding a renewable aspect to the practice.

6. Vision analysis: does growing a cocktail cover crop align or bring you closer to the overall goals for your farm or ranch and fit into your context?

7. Gut check: after going through all of the above questions, how do you feel about growing a cocktail cover crop? Do you have a 'good gut feeling' about it?

Monitoring and Evaluating Decisions

Monitoring decisions is always a good management practice, particularly if it involves implementing a new practice, and is always helpful to evaluate things at the end of the growing season. The above decision making process can also be used to evaluate a decision, where plans can be altered as needed, projected costs and revenues can be compared to the actual, and biological outcomes can be evaluated. The biological goals and services can be measured with record keeping, feed and soil testing, monitoring soil structure, soil water infiltration tests, soil health testing, and monitoring animal performance.

"We've always been looking for something to feed our cattle. Before, we were growing straight cereals, and sometimes we didn't get the tonnage out of it. Ever since we've been growing cocktails, we have eliminated that risk. We've always been able to harvest enough forage for our cattle, plus some to graze."

- Faron Steffen
Grimshaw, AB

Touring a cocktail blend for silage at Conrad Dolen's in the Fourth Creek area, July 2017. Photo: PCBFA

Choosing a Cocktail Cover Crop Blend

Choosing a Cocktail Cover Crop Blend

When creating a cover crop blend, it is important to note that there is no silver bullet, end-all, be-all blend. What are you looking to achieve from planting a cocktail cover crop? Quality grazing, extending the grazing season, stored forages (including greenfeed and silage), improved soil health, weed suppression, improving field water infiltration, nutrient cycling, and erosion control are all potential reasons for growing a cover crop. More questions to ask yourself include: what is your soil type, when and how will the crop be seeded, what kind of moisture are you expecting to be available to the crop, and when are you intending to harvest or use the crop. Keeping mixes simple and including species that are easily sourced and affordable is a key piece of advice that producers who have been growing cocktails for several years will pass on, which is also supported by applied research that PCBFA has conducted.

Species Considerations

There are many forage species that can be selected for a cocktail cover crop mixture. It is important to know the characteristics of the various species that are available. A cocktail cover crop mixture can be selected from a diversity of plant families (i.e., broadleaf, grasses, and legumes), corresponding to different plant functional groups (e.g. nitrogen-fixers; N scavengers, weed suppression). It is also important to consider if species are warm or cool season and the function that each provides to your goals. Thus, a cover crop mixture that contains a diversity of species, each differing in functional traits could be expected to provide a greater diversity of services relative to a mono-culture or even a two-species cover crop. Each crop species in a cocktail may reach maturity at different times, therefore providing green forage and a living root in the soil continuously through the growing season.

When making decisions about which cover crop species to include in a cocktail, producers need to be aware of the adaptation, potential forage productivity and ecological stability of any newly introduced crop species to the Peace Region. Cool season annual forage-type crop varieties such as barley, oats, triticale and field peas are well suited to western Canadian growing conditions and provide acceptable forage yield and quality for winter grazing. Therefore, it is an ideal option to include such crops in a cocktail.

Adding in warm season species helps to add diversity and can keep a green plant with a living root in the soil longer into the growing season than most cool season species which mature more quickly. They are, however, easily damaged by cool temperatures. They require warm soil to germinate (7-10 degrees Celsius) and warmer temperatures to thrive in the summer. They are also drought tolerant and will outperform cool-season species in hot, dry weather.

Grass Species

Grass species produce high biomass in most blends. They have a fibrous root system that helps in preventing erosion by stabilizing the soil, they are excellent hosts for mycorrhizal fungi and they also help in breaking up a hard-pan if they develop an extensive root system. Grasses are nitrogen scavengers, as they use a lot of nitrogen, and are a good fit to help reduce nutrient leaching and runoff.

To help mitigate risks with seeding a multi-species crop, producers in the Peace usually add easy to access species that are proven to grow well in the region for their cool season grass species, including oats, barley or triticale. In the Peace, proven cool season species include spring cereals, winter cereals,

and species like annual ryegrass. Warm season species that have done well in the Peace include proso millet, sorghum-sudan grass, and corn.

Broadleaf Species

Broadleaf species are known for staying green well into cooler fall temperatures and are producers of high quality residue as they are quick to rot at the end of the season. Many broadleaf species are nitrogen scavengers, with roots that vary with the species – some fibrous and some with sizable taproots. The range of benefits provided by this group of species varies, including loosening of a hard pan, smothering weeds, and acidifying the rhizosphere. Some broadleaf species such as brassicas do not colonize mycorrhizal fungi, which is a factor to consider when selecting a species such as forage turnips or radishes. These species also typically require high amounts of nitrogen and sulfur.

In the Peace, ideal cool-season species include: turnips, radishes, forage brassica, and kale and collards. Buckwheat is a warm-season broadleaf option.

Legume Species

Legumes are nitrogen fixers, therefore a great option for adding to a cocktail mixture. With an appropriate population and the proper inoculants in a mix, we can effectively fix free nitrogen from the air to feed the crop. Legumes form great associations with mycorrhizal fungi, which is the mechanism by which legumes share their nitrogen with grass species. They have a variety of root structures from shallow, fibrous roots to deep tap roots. They do require phosphorus and potassium to grow.

Popular legume species in the Peace include: hairy vetch, crimson clover, subterranean clover, berseem clover, and field peas.

Forbs

Forbs are herbaceous, flowering plants without significant woody tissue above or at the ground. It is not a grass or a tree/shrub, but can be described as something in between. It's a word commonly associated with rangeland ecology. Including forbs adds another dimension to diversity and they are also great for attracting pollinators!

Forbs that grow well in blends in the Peace include phacelia and sunflowers.

Following is a summary of PCBFA's research into 50 different species for inclusion in cocktail cover crop mixes. This summary is based on PCBFA's small plot trials that took place in Fairview, Teepee Creek, and High Prairie, AB, between the years 2014 - 2020. For more in-depth information on successful varieties by region, please check out PCBFA's full research reports at peacecountrybeef.ca/trial-reports.

PCBFA Staff maintaining small plots, June 2020. Photo: PCBFA

Species Tested by PCBFA

Species Tested by PCBFA in Small Plots (2014-2020)	Plant Family	Cool or Warm Season	Competitiveness in a Blend	Approx Seeds/lb	Root Type	Root Depth	Mycorrhizal Support	Pollinator Attractor	Flood Tolerant	Drought Tolerant
Annual Ryegrass	Grass	Cool	High	190,000	Fibrous	Medium	x		x	
Balansa Clover	Legume	Cool	High	500,000	Tap	Deep	x	x	x	
Barley	Grass	Cool	High	13,500	Fibrous	Shallow	x			x
Berseem Clover	Legume	Cool	High	140,000	Tap	Shallow	x	x		
Buckwheat	Broadleaf	Warm	Medium	20,000	Fibrous	Deep		x		
Chickling Vetch	Legume	Cool	Low	2,500	Tap	Medium	x	x		x
Chickpea	Legume	Warm	Moderate	5,000	Tap	Deep	x			x
Chicory	Forb	Warm	Medium	425,000	Tap	Deep	x	x		x
Common Vetch	Legume	Cool	High	12,000	Tap	Medium	x	x		x
Corn	Grass	Warm	Low	2,000	Fibrous	Deep	x			x
Cowpea	Legume	Warm	Poor	4,600	Tap	Deep	x			x
Crimson Clover	Legume	Cool	High	140,000	Tap	Deep	x	x		
Dry Bean	Legume	Warm	Low	1,800	Tap	Medium	x	x		x
Fababean	Legume	Cool	Moderate	1,500	Tap	Medium	x	x	x	
Fall Rye	Grass	Cool	Moderate	19,000	Fibrous	deep	x			x
Fenugreek	Legume	Warm	Low		Tap	Medium	x	x		x
Festulolium	Grass	Cool	Moderate	227,000	Fibrous	Medium	x			x
Forage Brassica	Broadleaf	Cool	High	170,000	Tap	Deep			x	x
Forage Collards	Broadleaf	Warm	High	175,000	Tap	Deep				x

Nitrogen Fixer	Regrowth After Forage Harvest	Average Dry Matter Yield (t/ac)	Average Dry Matter Crude Protein (CP%)	Average Dry Matter Energy (%TDN)	Notes about Growing in the Peace Region
	x	2.24	14.9	66	Grows quickly and is competitive in a mix. Waxy leaves can get wiry when plant dries down. Quick to regrow after being cut.
x		1.33	16.9	64.8	A winter annual from Australia. Relatively new forage crop to North America for use as a cover crop. Competitive in a cocktail blend in the Peace
	x	3.47	12.3	68.4	Grows well and reliably in the Peace, establishes quickly. Does not tolerate prolonged heat. Recommended as a base species to design a blend around. Be wary of rough awns in a grazing system.
x		2.24	15.7	64.3	Slow to establish in the spring, but grows fast once established.
		3.35	13.7	61.7	Excellent weed suppressor, and can increase phosphate availabilty for the following crop. Short season means it can reseed itself. Can be choked out of a blend if seeded too early, and can outcompete a blend if seeded at too high a rate. Can cause photosensitivity if animals consume too much.
x		2.07	19	63.5	Seed contains the neurotoxins BOAA & BAPN which can cause lathyrism. Ensure that grazing or forage harvesting occurs prior to flowering. Recommended for use as green manure.
x		0.99	25.2	66.2	Has good feed quality, however generally has poor establishment in PCBFA trials.
	x	1.06	16.6	70.7	Short-lived perennial with fair winter hardiness. Contains tannins and high in sugar, making it a good feedstuff. Performance in the Peace is hit-and-miss as it requires heat and adequate moisture.
x		1.83	20.7	65	Similar to Hairy Vetch with excellent nitrogen fixation, but not as winter tolerant. Natural resistance to glyphosate & Group 2 herbicides, means it can become a weed. Dry down in a haying system is slow, and can cause lodging in the crop. Seeds contain cyanide - can cause death in cattle and horses if seed is ingested in quantity
		5.64	10.5	67.1	Does not tolerate competition in early growth stages. Recommended to interseed other species once corn reaches 5-6 leaf stage for best success.
x		1.09	26.3	70.4	They thrive in hot, moist zones where corn flourishes, but require more heat for optimum growth. Therefore, not a species that can be depended on in the Peace
x	x	2.14	14.9	59.7	Excellent nitrogen fixer and pollinator favourite. Slender, fine steams and leaves makes it a favourite for inclusion in grazing, haying, and silage blends. Slight bloat risk depending on the amount in a grazing system.
x		1.51	24	66.2	Yield varies depending on the year. Seed is very large and fragile. Grows well in extreme Southern Alberta, cannot be depended on in the Peace Region.
x		1.95	23.3	62.7	Yields vary depending on the year. Performs well in a wet year with periods of heat.
	x	1.75	14.6	69.7	When seeded in the spring, it stays vegetative all summer long. Has allelopathic properties that suppress weeds, but can also affect future rotation. Works well as a fall-seeded cover crop in the Peace. Caution of ergot in grain.
x		0.77	19.3	64.3	Thrives in heat, and in well-drained soils. Is indeterminate, meaning it grows late into the season. Due to high heat unit requirements, it is not a dependable species in the Peace Region. Grown for seed in Southern Saskatchewan.
	x	2.02	15.1	70.8	Perennial cross between Meadow Fescue or Tall Fescue and Perennial Ryegrass or Italian Ryegrass. Relatively short lived. Fescue-types tend to be more winter hardy. Good regrowth after harvest, very palatable.
	x	2.57	15.1	71.7	High quality feedstuff, good to add to a mix for a protein, energy, and yield boost. Very competitive in a mix. Large leaves are very palatable and regrow quickly. Good species for any forage system. Frost tolerant, so caution for nitrates in fall grazing systems.
	x	2.32	18.1	73.8	Grows quickly and is competitive in a mix. Although a warm season species, is competitive when seeded in cooler temperatures. Strong, deep taproot scavenges nutrients deeper in the soil. Quite frost tolerant, can cause nitrate issues in fall grazing systems. Is a biennial, but typically winterkills in the Peace.

Species Tested by PCBFA

Species Tested by PCBFA in Small Plots (2014-2020)	Plant Family	Cool or Warm Season	Competitiveness in a Blend	Approx Seeds/lb	Root Type	Root Depth	Mycorrhizal Support	Pollinator Attractor	Flood Tolerant	Drought Tolerant
Forage Rape	Broadleaf	Cool	Medium	170,000	Tap	Deep			x	
German Millet	Grass	Warm	Low	220,000	Fibrous	Medium	x			x
Hairy Vetch	Legume	Cool	High	12,000	Tap	Medium	x	x		x
Italian Ryegrass	Grass	Cool	High	227,000	Fibrous	Medium	x		x	
Japanese Millet	Grass	Warm	Medium	140,000	Fibrous	Medium	x			x
Kale	Broadleaf	Cool	High	145,000	Tap	Shallow				x
Lentils	Legume	Cool	Low	10,000	Fibrous	Deep	x			x
Lupins	Legume	Cool	Medium	15,600	Tap	Deep				x
Oats	Grass	Cool	High	12,000	Fibrous	Deep	x			x
Peas	Legume	Cool	High	2,000	Fibrous	Medium	x	x		
Pearl Millet	Grass	Warm	Low	82,000	Fibrous	Medium	x			x
Persian Clover	Legume	Cool	Medium	140,000	Tap	Medium	x	x		
Phacelia	Forb	Cool	High	240,000	Fibrous	Shallow	x	x		x
Plantain	Broadleaf	Cool	Medium	200,000	Tap	Medium	x			x
Proso Millet	Grass	Warm	Medium	80,000	Fibrous	Medium	x			x
Radish	Broadleaf	Cool	High	30,000	Tap	Deep				
Serradella	Legume	Cool	Medium	18,500	Tap	Deep	x	x		x
Siberian Millet	Grass	Warm	Medium	220,000	Fibrous	Medium	x			x
Soft White Wheat	Grass	Cool	Medium	15,000	Fibrous	Medium	x		x	x
Sorghum	Grass	Warm	Low	16,000	Fibrous	Medium	x			x

Nitrogen Fixer	Regrowth After Forage Harvest	Average Dry Matter Yield (t/ac)	Average Dry Matter Crude Protein (CP%)	Average Dry Matter Energy (%TDN)	Notes about Growing in the Peace Region
	x	2.2	21.6	73.5	Being high in protein, and very palatable, makes this a good addition to grazing or silage mixes. Slow to dry down for hay. Not very drought or heat tolerant, and not as competitive as forage brassica or forage collards. Better fit in a lower diversity mix.
		2.3	16.9	62.6	Relatively low water use requirement, but not very drought tolerant. Performs relatively well in a monocrop, low yielding in cool years or high competition. Wide, waxy leaves makes hay dry-down difficult, but is a strength for a swath grazing or stockpiled grazing blend.
x	x	1.76	22.7	64.6	Slow to establish, but can outcompete most species once established. Excellent nitrogen fixation and yield makes it a producer favourite. Glyphosate & Group 2 herbicide resistance means it can become a weed if overwintered. Dry down in a haying system is slow, and can cause lodging in the crop. Seeds contain cyanide - can cause death in cattle and horses if seed is ingested in quantity
	x	2.32	14.5	69.8	Short lived biennial that normally winterkills in the Peace. Fine leaves are very palatable in a grazing system. Very good regrowth after harvest
	x	2.13	12.8	65.8	Coarser than other millets. Establishes quickly and has good regrowth potential compared to other millets.
	x	2.29	21.4	74.3	Excellent species to boost protein and energy in a blend. Is a competative species in a more diverse blend. Is frost tolerant, so caution for nitrates in fall grazing system. Large leaves suppress weeds. Is a biennial, but typically winterkills in the Peace.
x		0.64	20.8	62.2	While good feed value, is a poor yielder in the Peace Country.
x		2.18	18	62.5	
	x	3.48	10.7	64.5	Grows well and reliably in the Peace, establishes quickly. Will regrow if cut during the vegetative stage. Recommended as a base species to design a blend around.
		3.74	16.3	63.9	A favourite for Peace Country mixes. Forage varieties that remain vegetative later in the season are recommended for late-season grazing or silage mixes.
	x	1.19	16.9	68.4	Not very competitive in a mix unless seeded with other warm season grasses. Grows well and fast in heat. Does not perform well in cool, wet summers.
x	x	1.78	16.2	68.2	Very fine annual clover. Slow plant establishment, but persistant once established. Lower yielding than other annual clovers, but high quality feed and good nitrogen fixation.
		2.04	15.4	59.1	A pollinator favourite! Provides very high quality nectar while flowering. Stays green well into the fall and is competitive in high diversity mixes. Seed needs to be buried in order to germinate - not a good species to broadcast.
	x	1.34	17.3	65.9	A low-growing perennial with hit-and-miss success in the Peace Region. Good feed quality and is a natural antibiotic and antiparasitic.
		2.69	13.3	65.3	Earliest establishing of the millets. Is not very shade tolerant, so can stuggle in mixes with lots of cool season, early establishing species. Has moderate drought tolerance.
	x	2.89	14.4	64.1	Two types - oilseed & forage varieties. Forage varieties produce excellent biomass for forage. When seeded in the spring, will grow more top, less root, and potentially go to seed prior to forage harvest. When seeded in late summer, will grow a better taproot that can break up hardpans and compaction.
x	x	1.24	22.9	64	Native to Australia. Prefers well-drained soils. Success in the Peace Region is hit-and-miss.
		2.16	13.7	64.6	Relatively low water use requirement, but not very drought tolerant. Performs relatively well in a monocrop, low yielding in cool years or high competition. Wide, waxy leaves makes hay dry-down difficult, but is a strength for a swath grazing or stockpiled grazing blend.
		3.84	11	66.4	High quality, later maturing wheat variety that reliably grows well for forage in the Peace.
		2.78	19	63.7	Is a grain variety, therefore relatively short in nature. Grows fast through warm summer nights, but needs adequate moisture. Under stress, frost, drought, and cool nights, can produce prussic acid.

Species Tested by PCBFA

Species Tested by PCBFA in Small Plots (2014-2020)	Plant Family	Cool or Warm Season	Competitiveness in a Blend	Approx Seeds/lb	Root Type	Root Depth	Mycorrhizal Support	Pollinator Attractor	Flood Tolerant	Drought Tolerant
Sorghum Sudangrass	Grass	Warm	Medium	16,000	Fibrous	Deep	x			
Subterranean Clover	Legume	Cool	High	70,000	Tap	Medium	x	x		x
Sugar Beet	Broadleaf	Warm	Low	10,000	Tap	Medium			x	
Sunflower	Forb	Warm	High	8,000	Fibrous	Deep	x	x		x
Teff	Grass	Warm	Medium	1,300,000	Fibrous	Deep	x			x
Triticale	Grass	Cool	Medium	12,000	Fibrous	Medium	x			x
Turnip	Broadleaf	Cool	High	195,000	Tap	Medium			x	x
Woolly Pod Vetch	Legume	Warm	Medium	10,000	Tap	Medium	x	x	x	x

Hairy Vetch (left), Crimson Clover (middle) and Phacelia (right) are favourites for Peace Region producers and pollinators alike. Photos: PCBFA

Nitrogen Fixer	Regrowth After Forage Harvest	Average Dry Matter Yield (t/ac)	Average Dry Matter Crude Protein (CP%)	Average Dry Matter Energy (%TDN)	Notes about Growing in the Peace Region
		2.35	16.5	65.8	Grows taller than sorghum, with some allelopathic properties. Grows fast through warm summer nights, but needs adequate moisture. Does not compete well in a mix when seeded early in the spring. Under stress, frost, drought, and cool nights, can produce prussic acid.
x	x	0.68	18.4	62.9	Short, branching annual clover. Very hardy and competitive. Works well in an intercropping or grazing system. Poor hay or silage biomass due to the shortness of the plant. Propagates by stolons, making it a fast speader and good weed supressor. Can become a weed if not managed
	x			79.5	Not very competitive in a mix. Requires heat and adequate moisture. Is a biennial, but typically does not overwinter in the Peace. Not recommended for blends in the Peace Region.
				77.3	Very good growing warm season broadleaf in the Peace. Quite competitive in a mix. Good in a grazing or silage mixture. Helps prevent crop lodging. Attracts pollinators and birds.
	x	1.42	19.3	67.1	Extremely small seed size can make seeding a challenge. Needs to be seeded shallow, into warm soil. Grows well during warm summers. Fast regrowth during summer months. Does not tolerate frost.
		3.58	10.7	66.4	Later maturing cool season cereal that reliably grows in the Peace. Not a large market for grain, therefore seed can be hard to find. Older varieties are very susceptible to ergot.
	x	1.64	25.1	74.7	Reliably grows in the Peace. Caution of bulbs in a fall grazing system. High protein and energy species. Very palatable to ruminants.
x		2.77	23	62.2	Is an allelopathic legume that can smother weeds. Is primarily used in orchard or vegetable rotations in the U.S. Seed can be poisonus to animals if ingested in high quantities.

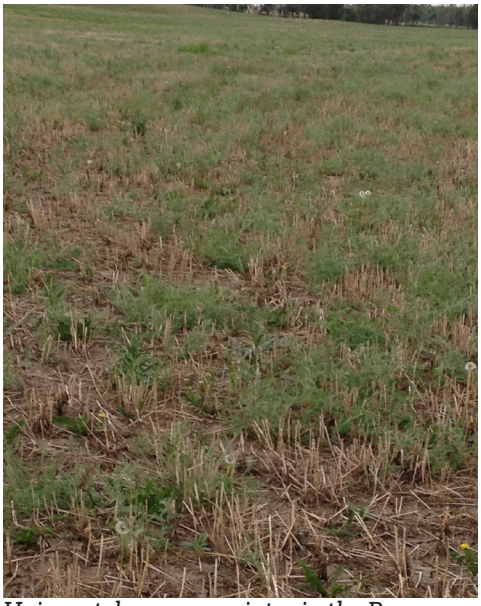
Producers and Industry Members Touring PCBFA's Small Plots at a Field Day at the Fairview Research Farm. Photo: PCBFA

Agronomic Considerations

Rotation

When seeding a cocktail, it is important to consider the crop that was grown in the field the year previous, as well as the crop that will be seeded the following year. In addition to giving the soil a break, crop rotations help to break pest bridges. A pest bridge is when a crop harbors a disease, insect, or contamination into the following crop. For example, growing a cocktail with a high concentration of forage brassica species before or after canola can create a pest bridge, since canola is a brassica and shares many of the same diseases and pests, such as flea beetles and clubroot. If clubroot is a concern and you'd like to include brassicas in a cocktail mixture, some species are poor hosts of the disease and pose a low risk, therefore research into the species and variety will help determine the risk level.

Some species being used in cover crops can be biennial or even perennials. If the goal is to have a living root in the soil for as long as possible, these biennial and perennial plants can be a great fit for that goal. However, if you are planning to follow the cocktail crop with another annual crop, there may be added expenses the next spring to terminate any species that overwintered. It is also important to note that some species have herbicide resistance traits. For example, hairy vetch has a natural resistance to glyphosate and Group 2 herbicides, however, it can be terminated with tillage or MPCA.



Hairy vetch can overwinter in the Peace. Pictured is hairy vetch growth after overwintering. Photo: Katie McLachlan

Fertility

One of the most appealing benefits of growing cocktail cover crops that we hear about is that fertilizer rates can be greatly reduced or even eliminated and a large forage crop will still be grown. This is a bit of a myth, as planting a cocktail cover crop doesn't necessarily mean synthetic fertilizers aren't necessary. Fertility rates are highly dependent on a number of factors, each unique to the farm and field, including: field history, soil type, soil testing and goals for the crop and how the crop will be used. If one of your goals in growing a cocktail cover crop is to reduce synthetic fertilizer rates, it's important to note that it must be done over time, and the soil ecosystem needs to be 'weaned off' slowly, especially if the field history includes high fertilizer rates.

Different species can scavenge different nutrients and assist with nutrient cycling. Turnips (pictured above) scavange many nutrients from the upper soil layers, releasing them as plant-available nutrients when the bulb breaks down the fol-lowing spring. Photo: Curt Hale

The idea that a cocktail cover crop doesn't need to be fertilized, or that fertility can be reduced after several years of cocktails comes from the concept of cover crops improving nutrient cycling in the soil by enhancing soil microbial activity that makes nutrients more available. For example, cover crops enhance nutrient cycling in a farming system by taking up nu-

trients that otherwise might leach out of the soil profile. Cocktail cover crops encourage populations of beneficial fungi and other microorganisms that help bind soil aggregates. For example, root-like extensions from fungi called hyphae take up water and soil nutrients to feed plants, including phosphorous that would otherwise be unavailable. They also help to bring nutrients to the upper soil profile from deeper layers, particularly if deep-rooted species are included in a mixture. A highly functional soil is capable of cycling nutrients very effectively and is one that has a high level of healthy, active biology; this usually means that the soil has been meticulously managed in a system that follows the principles of soil health. The process of building up the functionality of a soil that has poor structure, little to no soil biology, and a history of mono-cropping, short rotations, or overgrazing will take several years.

Our soil becomes dependent on synthetic fertilizer, and the ability to cycle its own nutrients is no longer needed. If land that has seen high fertilizer applications in the past is seeded suddenly with no fertilizer, chances are the crop will be a failure. However, with gradually decreasing fertilizer application over a few growing seasons, while incorporating the principles of soil health into field management, even the most depleted soils will eventually be able to begin nutrient cycling once again.

Legumes & Fertility

Legume species can be a tool to increase the nitrogen levels in soil, but there are a few things to keep in mind, if adding nitrogen is one of your goals. SARE's (Sustainable Agriculture Research & Education) cover crop handbook, Managing Cover Crops Profitably gives a list of factors to consider when using legumes to fix nitrogen:

- Using an inoculant on your legume species is key for having nitrogen fixation; it should be the correct rhizobial inoculant for the species you're growing. The inoculant should also be fresh and stored properly to be effective.
- Nitrogen fixation requires adequate amounts of several trace minerals to occur, including iron, potassium, sulfur, zinc, and molybdenum. When soil is low in these nutrients, legumes won't be able to fix nitrogen very effectively.
- Nitrogen fixation by legumes requires that the soil gets adequate air. Compacted and waterlogged soils don't allow nitrigen-rich air to get to the roots.
- Nitrogen fixing rhizobia don't like acidic soils and don't live long in soils with a pH of 5 or lower.
- If nitrogen-fixation is your goal, be sure to choose legume species with a high potential to fix nitrogen, such as a vetch; see the species chart on pages 14-19 of this guide.

A nodulating hairy vetch root. Photo: PCBFA

Overall, when deciding on if fertility should be added to a cocktail cover crop, either synthetic or biological (such as manure or a compost tea), a few things should be considered:

- What do the soil tests say? Using a biological soil test such as that available from the CARA Soil Health Lab or a Haney Test is worth considering. Analysis like this tell us more than conventional soil tests, including how biologically active or alive your soil is, and tracking this indicates the

availability of nutrients in your soil.
- What kind of forage yield do I need out of this cocktail cover crop?
- What does the gross profit analysis look like for this crop? With the high price of fertilizer, this step is a must to ensure a return on the dollars paid for fertilizer
- Can I take an integrated nutrient management approach and consider applying any biological products (ie. compost tea, humics)

Timing of Seeding

Timing the seeding of a cocktail cover crop is difficult due to the differences in growing days among species. For example, barley only takes approximately 90 days to fully mature, whereas some species of forage brassicas stay growing and vegetative well past the first frosts in the Peace; while this can be challenging, it is also an advantage of growing a cocktail. When to seed your mixture is dependent on what the goals are for your crop. Mixes with primarily cool-season varieties will mature earlier in the growing season, whereas a mix with mostly warm-season varieties will mature much later in the season.

When a cocktail is seeded also depends on the end usage of the crop. If you are looking to cut the crop for stored feed like greenfeed or silage, seeding a cereal-heavy crop in mid-May will put you cutting the crop around mid-August when the cereals in your blend are at the mid to late dough stage. If you want to use the crop to extend your grazing season by swath grazing or to graze standing, you may want to hold off on seeding until mid June to ensure that the crop does not become too mature.

Seeding Rates

Determining a seeding rate for a cocktail mix depends largely on the number and type of species in a blend. You can choose from different methods to determine the seeding rates of each species in your blend, and information on seed germination, seed weight (and coated seed weight, if applicable), and percent mortality should be factored in as well.

- By the number of seeds per square foot, with a goal of approximately 1.5 million seeds/acre and up to a maximum of 1.75 million seeds/acre.

Crop Category	Crop Type	Variety	# seeds/ac (# plants/sq. ft.)	# seeds/lb	lbs/ac
Cereal	Oats	CDC Haymaker	375,052 (8.61 plants/sq ft)	15,000	375,052/15,000 = 25
	Barley	CDC Maverick	585,000 (13.5 plants/sq ft)	13,000	45
Legume	Hairy vetch		60,000 (1.38 plants/sq ft)	12,000	5
	Berseem clover	Frosty	134,000 (3.08 plants/sq ft)	134,000	1
	Forage peas	CDC Horizon	192,000 (4.41 plants/sq ft)	3,200	60
Brassica	Forage brassica	Winfred	127,500 (2.93 plants/sq ft)	170,000	0.75
Others	Sunflower (warm season)		8,000 (0.18 plants/sq ft)	8,000	1
		Total # of seeds/ac	1,481,500 (34.0 plants/sq ft)		137.8

- By percent of normal mono-culture seeding rate - similar to determining perennial hay blend seeding rates.

Crop Category	Crop Type	Variety	Suggested mono crop Seeding rate (lbs/acre)	% to be seeded in cocktail	Lb/ac
Cereal	Millet	Red proso	25	5.5	25 x (5.5/100) = 1.38
	Barley	CDC Maverick	108	40	43.2
Legume	Hairy vetch		20	20	4.00
	Crimson clover	H.O	15	4	0.60
	Forage peas	CDC Horizon	160	18	28.8
Brassica	Forage brassica	Daikon radish	6	12.5	0.75
			Total	100	78.7

- By number of species in the mix - equal amounts

In a 6 species crop mix, if you like to have equal amounts of all components in the final stand, then start with a seeding rate at 1/6 (17%) of a monoculture rate.

Crop Category	Crop Type	Variety	Suggested mono crop Seeding rate (lbs/acre)	Amount required in the mix (Mono rate/total # of crops)
Cereal	Millet	Red proso	25	25/6 = 4.17
	Barley	CDC Maverick	108	18.0
Legume	Hairy vetch	Common	20	3.33
	Crimson clover	H.O	15	2.50
	Forage peas	CDC Horizon	160	26.67
Brassica	Forage brassica	Daikon radish	6	1.00
			Total	55.67

Method ensures that seeding rates for each species in the mixture are proportional to their monoculture rate.

Note:

Method can only adjust for the number of annual crop species in a mixture but not the number of seeds per pounds for the different species.
Therefore, the total number of seeds per acre would vary between mixtures.
Aim for 125-130 percent of full seeding rate to increase the number of seeds per acre in cover crop blends.

- Commercial, pre-mixed blends will have seeding rates available on the tag.

Mixing Your Seed

One of the biggest obstacles of getting ready to seed a cocktail blend is how to mix your blend. Most commercial blends come pre-mixed, but if you are blending a mix yourself, it can be a head-scratcher.

Agronomic Considerations

Below are suggestions from some local producers on how they blend their mixes:

"We will fill a grain truck with our oats and barley, then auger it out into another truck. While emptying the truck, we add in our bagged seed right in the auger. We auger it back and forth a few times, and it mixes up really well." - Garth Shaw, Fairview, AB

"We have an old canola treater that we mix our small seed in. For the larger seed, I clean out my silage wagon real well and mix it in there. It works quite well as it has a scale on it, so you know what all you have." - Allan McLachlan, Fairview, AB

"We buy most of our seed through South Peace Grain in Dawson Creek, and they are able to pre-blend it for us. If I am adding any of my own peas or barley, I will mix that in when I am filling the drill." - Dan Martin, Bay Tree, AB

"We purchase all of our seed pre-mixed." - Faron Steffen, Grimshaw, AB

Seeding

Seeding depth can be a challenge given the diverse seed size of all the species that may be in a mix. Small-seeded species, such as millet, may flourish best when planted relatively shallow, while other larger-seeded plants, such as corn or peas, will thrive when seeded deeper. If possible, producers with access to a drill that has a side-band option may want to put small–seeded crops in one tank and large-seeded crops in another tank to seed each group at the most appropriate depth. Another option may be to make two passes, one pass seeding the smaller-seeded group followed by another pass where the larger seeded group is planted. Another alternative for achieving different seeding depths is to make a single pass at an intermediate depth that will suit the majority of the plants in the mix.

A blended, 12-way mix ready to seed. Photo: Katie McLachlan

Whether it's a 6 foot plot drill, or a 70 foot Seed Master, where there is a will, there is a way to seed a cocktail. Left Photo: Dan Przybylski. Right Photo: PCBFA

Harvest

Broadcast seeding is also an option and many producers successfully seed by a broadcast method. Selecting for species that can be planted at shallower depths is ideal, and the seeding rates will need to be increased. Moisture conditions will need to be considered, as if it is extremely dry, the chances of the crop being successful are much lower. Seed to soil contact is key when broadcasting. Some area producers have had success seeding their smaller seed through a Valmar mounted on the front of their drill or harrow-packer bar.

Swathing a Cocktail Photo: Gary These

Weed Control

Weed control in a cocktail cover crop can be a challenge due to not being able to apply herbicide through the growing season. A weed is defined as 'a plant that is growing where it is not wanted.' Therefore, it is important to ensure that the field has good weed control prior to seeding. That being said, your goals for your cocktail crop come into play when you analyze your tolerance level for weeds; weeds can still provide feed value, and if it's possible to graze or cut a crop for silage or swath grazing before a problem weed goes to seed, then it could be a form of weed control. Weeds should always be scouted for, especially if herbicides are not being used, as some weeds, such as mares tail can be toxic when cut and dried in feed.

A cocktail in the swath. Photo: Katie McLachlan

Harvesting a Cocktail Cover Crop

As discussed in the Goals Section of this guide, there are a magnitude of different end uses for a cocktail cover crop. In this section, we will discuss the benefits and limitations of various end uses here in the Peace Country.

Grazing

In the Peace, there is an ever increasing popularity in grazing standing cocktails throughout the growing season, as well as extending the grazing season with a standing cocktail or by swath grazing the crop. When planning to graze a cocktail, like when grazing other crops, it is recommended to cross fence the field into an appropriate size for the herd. When turned into an entire field, there is a risk of the herd selectively grazing the species they prefer like barley or oats, which can cause acidosis depending on the stage of the crop.

Cattle grazing a standing cocktail. Photo: PCBFA

Harvesting a Cocktail Cover Crop

Silaging/Greenfeeding

Cocktail cover crops typically make a high quality stored forage. Timing the harvest of a diverse forage mixture for silage or greenfeed is a bit more difficult than timing a cereal mono-crop of cereals. For cocktails that include a cereal, it is recommended to swath the crop when the cereals are at the mid - late dough stage. Depending on the blend and the end goal for the crop, some producers will allow cereals like oats or barley to completely ripen prior to harvest to boost energy levels, while the warm or long season species like millet or forage brassica stay green and vegetative, and higher in protein.

Silaging a cocktail crop. Photo: Curt Hale

A Note on Feed Quality

PCBFA is proud to run a robust feed testing program for our membership. Since the popularization of cocktails in the area in 2014, the top feed test results have come from cocktail blends for silage, greenfeed, or grazing.

PCBFA small plot studies have found that many cocktail blends that include a grass, legume, broadleaf, and forb meet most or all of the nutritional requirements of a mature beef cow. Some producers have even been able to satisfy the needs of backgrounding or feeder cattle with cocktail mixes.

Local producers have winter grazed standing cocktail crops with cow/calf pairs, with lactating cows who were putting on fat in January.

Producers who are feeding cocktails as bales or silage have found that they very rarely need to supplement their rations with protein or energy.

A yearly summary of PCBFA Feed Testing Results can be found in our Annual Reports. Visit peacecountrybeef.ca/annual-reports for this feed test data.

Green Manure

Cocktail cover crops are trying to find a way into annual cash crop production. For producers who don't have livestock, an opportunity to try cocktails can come in the form of green manure. Green manure is the practice of growing a crop for the sole purpose of working it down and incorporating it into the soil. This is a common practice in the US where cover crops of fall rye or buckwheat are grown in the fall and spring between harvesting corn and seeding soybeans. Depending on the mix, and the stage of work-down, green manure can be an excellent source of nitrogen and other nutrients. At the time of publishing, PCBFA has just begun monitoring a field-scale green manure project.

Cattle swath grazing a cocktail mix. Photo: Ken Binks

A Caution on Toxicity

If cocktails are utilized for extending the grazing season late in the fall or winter, there are a few more consider-ations. When grazing annual forage around the time we start getting frosts, nitrates become a concern. Nitrates accumulate in a plant when it suffers damage that hurts the plant, but does not kill it. This can be caused by light frost, hail, and even by extreme prolonged weather events such as severe heat and drought, or prolonged cool, rainy periods. Some species are more at risk of nitrate accumulation than others. PCBFA studies have shown that many species of brassicas, like kale and forage brassica, are at risk of accumulating large amounts of nitrates during light frost events. This is due to the long growing season of these plants and that they stay green long into the fall. Brassicas can also survive much colder freezing events compared to annual crops like oats or barley.

Signs of acute nitrate poisoning in cattle include: increased heart rate, muscle tremors, vomiting, weakness, blue-grey mucous membranes, excess saliva and tear production, depression, labored or violent breathing, staggered gait, frequent urination, low body temperature, disorientation, and an inability to get up. Animals often lie down after a short struggle. In most cases of acute poisoning, Nitrate toxicit managed can are animals y be found dead before any signs of toxicity are observed.

Nitrate toxicity can be managed however. If intending to graze a mix with suspected elevated nitrate levels, ensure that cattle go out into the crop when they are full. Also, do not turn them out on to an entire field, give them just small pieces at a time. The rumen can acclimate to ingestion of high amounts of nitrates, but they need to be introduced slowly, Ensuring that cattle have ample access to stockpiled grass, or grass or aftermath bales when first exposed to high nitrate feed will help them to regulate themselves.

A cocktail blend with ripened cereals, green forage brassicas, and sunflowers. Photo: Katie McLachlan

Some warm season annuals like sorghum and sorghum-sudangrass also have risk of accumulating prussic acid under similar circumstances

that other annual plants accumulate nitrates. Prussic acid is also known as hydrocyanic acid, which is a precursor to cyanide. Symptoms of prussic acid poisoning typically occur 15-20 minutes after the toxin is ingested, and death can occur as quickly as 2-3 minutes after onset of symptoms. Signs of prussic acid poisoning include; breathing difficulties, anxiety, stumbling or staggering, moaning, muscle tremors, dilated pupils, bloat and convulsions. These symptoms are caused by the inability of oxygen to properly flow through the body, which eventually causes the animal to die from asphyxia.

Hairy vetch, common vetch, and chickling vetch seed can also be poisonous to livestock. The seed of these species contains small amounts of cyanide. If ingested in large quantities, livestock will react very similarly as they do to prussic acid poisoning, as cyanide inhibits the ability of the body to transport and absorb oxygen. If you have a crop with high amounts of podded, seed producing vetch, use caution.

Conclusion

In conculsion, cocktail cover crops are a tool in a producer's toolbox to increase feed quality, feed yield, and improve soil health. There is a lot of hype currently surrounding cocktail cover crops as a silver-bullet solution to all of your farm's soil and fertility issues, however, those claims must be taken with a grain of salt.

Every farm is different. Different soil types, climatic conditions, management, classes of livestock or no livestock at all, and risk tolerances, all attribute to whether or not a cocktail cover crop is a fit for your farm. Before deciding to jump in with both feet, decide what your long term farm goals are, and work backwards from there to determine if cocktails are going to help you achieve that goal or not.

We encourage you to discuss cocktail cover crops with your neighbours - everyone has a different per-spective, and sometimes that different perspective can help us break through our paradigms. PCBFA staff are also available to answer any technical questions that you have about growing these crops in the Peace Region. Managing Cover Crops Profitably, 3rd Edition - SARE Outreach

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