# Food Sovereignty

## A Guide for Indigenous Youth

Funded by the...

Ontario Trillium Foundation

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# Acknowledgements

We wish to acknowledge the contribution that youth from the Chippewas of the Thames First Nation have made to this Guide. It was because of their leadership and desire in learning how to pilot their own food sovereignty project that we were able to form this resource.

This resource was developed by the Legacy of Hope Foundation (LHF) with funding from the Ontario Trillium Foundation (OTF).

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A project by the...

Legacy of Hope Foundation

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# Who We Are

The Legacy of Hope Foundation (LHF) is a national, Indigenous-led, charitable organization that has been working to promote healing and Reconciliation in Canada for more than 20 years. The LHF's goal is to educate and raise awareness about the history and existing intergenerational impacts of the Residential and Day School System and subsequent Sixties Scoop on Indigenous (First Nations, Inuit, and Métis) Survivors, their descendants, and their communities to promote healing. The LHF works to encourage people to address discrimination and injustices in order to contribute to the equality, dignity, and respectful treatment of Indigenous Peoples and to foster Reconciliation. LHF has celebrated our 20-year Anniversary of working with Survivors, Indigenous communities, researchers, curators, and educators in developing educational resources that increase Canadians' knowledge of the history and effects of the Residential and Day School System and other colonial acts of oppression. Our products include mobile exhibitions, websites, applications, Activity Guides, research publications, and several bilingual curriculums that range from kindergarten to adulthood, as well as podcasts, Workshops and Training.

Visit legacyofhope.ca for more information, to request resources, to buy an orange t-shirt, or to donate to our Foundation.

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# Introduction

In 2020, the Legacy of Hope Foundation (LHF) developed a plan for the creation of a new food sovereignty project that would be led by Indigenous youth. This project grew out of the mandate of the LHF to promote healing and rejuvenation of Indigenous communities harmed by the impacts of Residential and Day Schools, the Sixties Scoop, and other colonial policies. Food insecurity was a serious issue prior to COVID-19, but was greatly exacerbated by the pandemic. The LHF was successful in obtaining funding from the Ontario Trillium Foundation (OTF) through the Seed Stream. This funding allowed the LHF to pilot this important project which we hope, marks the beginning of other youth-led Indigenous agriculture initiatives. Initially conceived pre-COVID-19, the project experienced many challenges brought on by the onset of the pandemic. Despite revolving lockdowns and restrictions, the project was able to meet all of its goals and objectives. This success was made possible thanks to the extraordinary individuals, who all seemed to appear when we needed them, each bringing a critical element to bring this project to fruition. With support from key stakeholders, the LHF shifted the entire project from its original conception of in-person into a blended-online model.

The first stage of the project had us gathering online with Traditional Knowledge Keepers, food experts, and Indigenous youth to facilitate learning about the various methods of producing food using Indigenous and non-Indigenous knowledge and practices. The second stage of the project then focused on which knowledge and practices were most relevant to the community and how to start applying it. What began as a simple introduction to these topics soon grew into a vast amount of knowledge being shared with the youth group by passionate individuals. As we progressed through these valuable teachings, we noticed much of this food knowledge could be categorized as both season-specific and sometimes community-specific. The identification of this pattern led to the development of this new Food Sovereignty Guide, which the LHF has designed as an introduction to everything we have learned. With this Guide, we hope more youth in more communities will also be able to benefit from this knowledge. Our hope is that you, the reader, will feel both inspired and empowered that you too can begin growing your own local food. This guide is for you, to help you on this important journey of Indigenous healing, growth, rejuvenation, and leadership development.

# A Brief Backgrounder

At first, when Settlers arrived on this continent, many Indigenous Peoples welcomed them and helped ensure the survival of these newcomers. They were shown how to survive off the land and in many cases, also formed alliances. Treaties, agreements, and partnerships were made to coexist with one another in peace and harmony, living and sharing the land, side by side, but not interfering with one another. These early Treaties were not about the surrender of land. They were negotiated to obtain First Nations' economic and military cooperation. In war, settlers and First Nations formed alliances, and in trade each enjoyed the economic benefits of working together. For over 300 years, Settlers and Indigenous Peoples interacted with one another as distinct Nations. Over time, as more Settlers arrived the colonies began to shift away from needing to work with Indigenous Peoples and instead towards claiming land ownership and access to resources. Their hunger for land and money increased dramatically. Settlers and the new Government began to view the Indigenous Peoples as a "problem." Many of the former agreements, which determined the land's mutual use and benefit, were dishonoured by the Settlers in favour of acquiring the land and its resources for themselves. Laws and policies such as the *Indian Act* and the creation of reservations began to prevent and criminalize Indigenous Peoples from occupying their traditional territories. More laws followed that prevented them from leaving reserves. Their traditions and practices, spirituality, and cultures then began to be criminalized. By the 1800s settlers began the process of removing Indigenous children from their families to send them to Day Schools in order to break the family bonds and culture, but the process was seen as taking too long so the Government worked with churches to make new laws and policies and Indigenous children as young as three years old were forced to attend Residential Schools. The schools were often many hours from their communities and some families were unable to see their children for years at a time, if at all, for up to 10 years in some cases. More laws were put into place to criminalize any parents who tried to keep their children from this process. Some hoped their children might benefit by being introduced to western education, unfortunately, in most cases, this was not the reality. When 'peace and friendship' aspects of the Treaties shifted to a focus on "killing the Indian in the child" and "destroying all that was Indigenous" through the abuses directed at seven generations of children and their families, it severely disrupted generations of Indigenous land-based food systems and ways of being for entire Nations. Many of these changes were gradual and some were more sudden. With the imposition of many new laws and policies specific to Indigenous Peoples, along with the experiences of generations at Residential Schools, there began a severe disruption in the passing on of Traditional Knowledge, cultural practices and original ways of living off the land. From the removal from their lands and territories and the displacement from traditional hunting, fishing, gathering, harvesting grounds, Indigenous Peoples were forced to eat foods that were contrary to their way of life for more than 15,000 years prior. These effects continue to be experienced by Indigenous Peoples today. It is our hope that we can facilitate the reclaiming of our traditional teachings relating to seeds, planting, harvesting, and food sovereignty with Indigenous communities across the country.

# The Residential School System


Beginning in the early 1800s and continuing into the late 1990s, Indigenous children in Canada were taken from their homes and communities to be placed in institutions called Residential Schools. In contrast to public schools, Residential Schools were boarding schools for Indigenous children that were run by various religious orders through an ongoing partnership and funding relationship with the Federal Government. Administrators of these schools became both teacher and caretaker, in addition to gaining parental rights over the students. The Residential School System as a whole was chronically underfunded with broad occurrences of disease, hunger, and overcrowding being noted as early as 1897. During their over 160-year existence, more than 150,000 Indigenous children between the ages of three and seventeen years old attended schools across the country, where the vast majority would suffer through all forms of abuse and neglect, including sexual, physical, emotional, and mental abuses. Students were forbidden and often beaten for speaking their language or practicing their culture in any way and many endured shaming and inhumane punishments as the extent of the education included teaching them the preferred language and religion of the religious order along with having them perform physical labour such as farming, scrubbing floors, etc.

The Residential School System (RSS), included more than 160 schools that operated across Canada between 1831 and 1997. The Federal Government only counts the 139 schools within the Settlement Agreement that was later negotiated with Survivors, however, this number is controversial and excludes provincially administered schools, as well as Hostels and Day Schools. Residential Schools existed in almost all provinces and territories, and in the North also took the form of hostels and tent camps. The earliest recognized and longest-running Residential School was the Mohawk Institute, in Brantford, Ontario, which operated from 1831 to 1962. The last federally-run school, the Gordon Indian Residential School in Punnichy, Saskatchewan, closed in 1996 and was subsequently demolished. Grollier Hall in Inuvik, Northwest Territories, was run by the Anglican Church and was in operation until 1997. Although this marked the end of the Residential School era, the Day Schools and Government policies regarding the removal of Indigenous children from their families and placing them into non-Indigenous homes began a new era of disconnection and damage to families and communities and their Nations.

# Food Sovereignty

*Indigenous Peoples already had rich systems of education, which included rich nutrition and healthy eating through land-based food systems. Many of the children who attended the Residential School System went from these generations of critical land-based knowledge and cultural teachings from their families to instead lessons that emphasized western religions. Indigenous ways of identifying seeds, growing, gathering, collecting, preserving, and sharing food was once common knowledge that was passed down through Oral Tradition, from one generation to another for thousands of years. The loss of healthy eating and living knowledge is one of the major impacts of Residential and Day Schools, the Sixties Scoop, and other colonial policies where the Government of Canada and churches significantly interrupted the relationship with food and family, and it is strongly felt in our communities today. Indigenous Peoples from across Canada have identified food supply instability as a contributing factor to the many social and economic issues in our communities. What has become apparent to us is that there are simple ways that we can mitigate food scarcity and it starts with producing food locally within the community. Restoring knowledge about traditional Indigenous foods helps in restoring knowledge about healthy living and healthy eating. The practice of growing traditional foods locally and sharing them within community is also a cultural practice that helps bring people together and cultivate healthier lifestyles. Across this country, Knowledge Keepers who still carry Traditional Indigenous Food Knowledge and Practices, are working hard to reignite these teachings and practices through what has become known as the Indigenous Food Sovereignty Movement.*

# Thank You

*The Legacy of Hope Foundation (LHF) wishes to thank the many individuals who had a part in bringing this knowledge together and helping to make this project a success. This includes speakers and teachers, volunteers, volunteer youth, youth leaders, and coordinators. Thank you to Ian Friderich from ZipGrow, Caleb Musgrave from Canadian Bushcraft, Nicole Davies from Sovereign Seeds, Hunter Cascagnette & Lindsay (Beze) Gray, Vick Slay (Principal at Antler River Elementary School at Chippewas of the Thames), Kingson Huff, Meaghan MacLeod, Alanis Deleary, Shawnah Albert, Carly Albert, Dallas Cornelius, Taylor Deleary, Sydney Kechego, Zhawanoobiik Riley, Michael Riley. Finally, the LHF would like to thank Darlene Whitecalf "Giigidoon Waase Kwe" (Talking Bright Woman) from Chippewas of the Thames. Although you are no longer with us to see the fruition of this project, we will always remember you for your love and determination for your community - Without you, this project would not have happened.*

*Chi-Miigwetch.*

# Spring

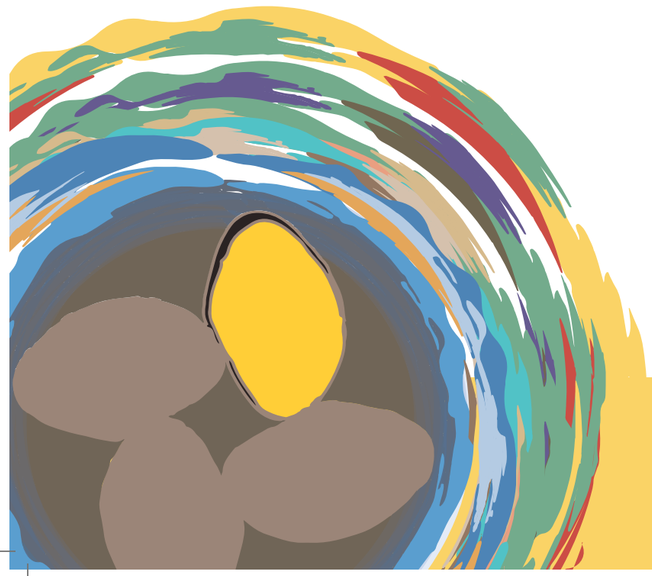
*Spring is located in the eastern quadrant of the Medicine Wheel. The east is the direction of the dawn - from which all beginnings come. We start our journey from the spirit world into the physical world, through birth and then childhood, through the eastern doorway. Each day the sun rises in the east and each year Spring brings us new life and new growth. Every morning we give thanks, because each day is a gift. To honour this gift we give tobacco.*

A time for Planting Seeds in the Soil

# Our Seeds Connect Us To Our Ancestral Roots

Knowing traditional foods begins with knowing our traditional seeds. Traditional seeds, or what are now referred to as Indigenous seeds, are all 'heirloom' seed varieties. When a seed is named 'heirloom' it simply means that particular seed has been passed down within a family or community for generations and is a very old variety. Many Indigenous Nations have their own seed varieties that were planted within their communities for generations and for thousands of years. These seeds sustained their communities with food and were often used for trading with other Indigenous Nations. Each seed variety has its own name in the community's Indigenous language. Later, when Settlers began to grow these seeds, they renamed them with 'common names.' This is the reason you will sometimes find one seed with multiple names – for example, Scarlett Runner Beans are traditional known as Bear Paw Beans.

Today many of the traditional seed names are not widely known. The following are some examples of Nation-specific seeds:



## Algonquian

The Algonquian* Pumpkin is an extremely rare cucurbit that originated from the Abenaki who came from the New England area. They also practiced 'Three Sister' methods, with the addition of sunflowers. The Algonquian Pumpkin is known for its sweet taste and how well its seeds survive storage. *The spelling of the squash's name "Algonquian" is because it originates from various Nations that speak the general language of Algonquin (such as the Abenaki), not just the Algonquin Nation.

## Haudenosaunee

The Deseronto Potato Bean is an extremely rare bean that originates from the Mohawk Peoples in Ontario, Canada. The Kanienkeha'ka Haudenosaunee (Mohawk or Iroquois) are well known for their agricultural methods, such as the 'Three Sisters' planting method. It is said that these beans have been grown for as long as 4300 years. Like their name, these beans are soft enough to be mashed like potatoes, and were often used this way.

## Cherokee

The Cherokee Trail of Tears Bean was originally grown by the Cherokee in United States of America (USA) part of North America. Most Indigenous Peoples deem themselves to be North American as many Nations traditionally and still today occupy territories in both Canada and the USA. This particular bean was said to be carried over the "Trail of Tears" from the Smoky Mountains in October 1838.

The beans were the primary component of their meals in dishes such as soups and stews, or they would be refried. They were often supplemented with rice, wild onions, and mushrooms. Traditionally, Cherokee Trail of Tears beans were grown with the other Three Sisters crops, such as corn and squash; as well as sunflowers and pumpkins in between.

## Odawa

The Odawa Bean originated from the Odawa tribe in Ontario, Canada. Odawa comes from the word "adaawe" in Anishinaabe, which means "to trade." The Odawa bean was often traded and found its way into neighbouring communities like the Ojibwe, Hidatsa, and even settler communities. They are a semi climbing variety with large beans that were used in soups.

## Indigenous Seeds Today

Today many of the Indigenous seed varieties that were held in communities and Nations over generations are no longer found within their original communities. The Indigenous food systems that once protected these seeds and sustained Indigenous communities became disrupted and many of the traditional seeds were forgotten or lost over time.

Due to a resurgence in interest, many of the Indigenous seeds that were displaced are now found stored within public and private collections, and other institutions and organizations such as public seed banks, universities, museums, etc. Some Indigenous Nations do still have traditional seeds, but they are not shared publicly in order to protect them.

For the Indigenous seed varieties that are still in existence, there is now concern that they are in even greater danger of being lost due to the agricultural industry's increased use of genetically modified organisms (GMO), seeds, and genetically engineered (GE) pesticides and herbicides. GMO pollen can be found travelling far through the air and can contaminate heirloom seeds through cross-pollination. Some refer to this as "trespassing pollen" because it creates a significant risk to those who still grow heirloom seeds. This is currently being considered a major threat to the genetic diversity of Indigenous and heirloom seeds.

## Rematriation of Indigenous Seeds

There is now a growing movement to return Indigenous seeds to their original communities. In the Indigenous seed movement, the act of returning these seeds to their original stewards is referred to as "Rematriation"rather than repatriation. The word repatriation refers to the process of restoring or returning something to its place of origin. Many Indigenous communities are familiar with this word, as it relates to the return of cultural items or physical artifacts that were taken and then returned. In the Indigenous seed movement, the maternal-form of the word, "Rematriation" was chosen to be used instead as it refers to the return of seeds back to Mother Earth.

## Planting Seeds is Ceremony

Seeds are imbued with Spirit. As such, the planting of seeds is a spiritual experience. It is an opportunity to honour, respect and nurture the seeds. The tradition of singing seed songs and of planting seeds as ceremony has been around for many years. In Anishinaabek tradition, the spirit of a seed is seen as an island and when we sing the seeds a song it is an invitation for them to wake up and to show them it is time to start rising. There are countless songs for the variety of seeds that exist. Though many seed songs have been lost, there are ones that remain and continue to be sung in the language today. In search of seed songs, one must seek out the seed keepers, in hopes of finding the songs that belong to each seed. When singing to seeds it is important to remember to be patient, seeds are on their own time. Once the seeds are sprouting above ground they do not need to be sung to anymore. Another part of the ceremony for planting seeds involves talking to the seeds and interacting with them before the planting season begins. Research shows if you speak positively around your plants, they will respond with vigorous growth. However, the opposite effect will happen if you speak to them negatively. Seeds also respond to resonance, sound, and vibrations in the Earth.

## Indigenous Planting Techniques

Indigenous Peoples have had always had respect for nature and a close relationship with the environment around them. This respect for nature can be found in Indigenous creation stories, where nature and animals were created first, and humans were created last. Living in harmony with Mother Nature is one of the main goals of Indigenous Agriculture. For this reason, the planting techniques developed around working with the natural landscape, the existing ecosystems and the surrounding environment. These kinds of planting techniques are also known as Permaculture and involve agriculturally sustainable systems designed to refrain from making dramatic changes to the natural ecosystems. Using natural resources is key to Indigenous Agriculture and Permaculture, some examples of which include natural watering systems, natural mulch, and planting above the soil - rather than tilling it. Using the environment around you was considered slow and inefficient by settlers. Instead, European techniques were implemented which included drastic changes to the land, such as flattening it and removing rocks and seemingly unnecessary plants from the area. The introduction of modern farming tools would then rotate the dirt, removing vital microorganisms from in the soil. The use of pesticides would then effect much of the insect life above the soil. Not only were such techniques unsustainable, they did, and still do harm the soil. Sustainability and prevention of damage is of great importance to Indigenous agriculture, many planting techniques have developed to prevent pests and parasites from attacking the crops in natural ways. As well, Indigenous planting techniques are focused on need and necessity, meaning that over-planting in one specific area tends to be avoided. A common indigenous practice has been the collection of the seeds that are of the most interest for the purpose of growing and consuming them in the future.

## Planting With The Moon Cycles

Indigenous Peoples didn't have books to refer to for knowing when or how to plant their foods. Instead, they learned about the environment around them and used Mother Nature's cycles. A major component of Indigenous agricultural knowledge involves recognizing the effects of the moon cycles on plants. This is due to the varying levels of lunar gravity and moonlight. In the past, communities were aware of the moon cycles and understood how to utilize it in order to plant their crops at the best possible times. Different stages of the moon cycles have different effects. In general, the best time to plant is when the moon is in half-moon and full-moon stages. This stage of the moon is also referred to as waxing, which means the moon is growing fuller. In addition, each quarter of the moon cycle can be paired with certain types of seeds that thrive in that quarter. For example, the first quarter was known to be ideal for plants that flower, such as asparagus and spinach, as well as plants that thrive above ground. In the Great Lakes region, the full-moon cycle that happens in June is considered the best time to plant Three Sister crops.

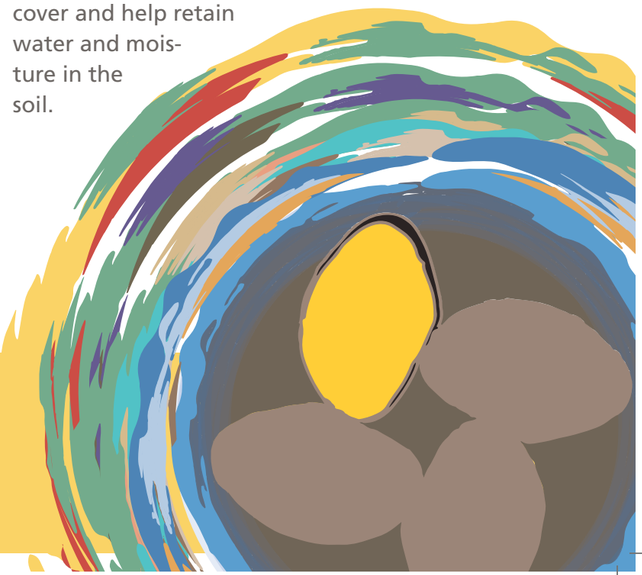
## Three Sisters Planting

Three Sister Planting methods were a common practice in many Indigenous communities across Turtle Island. The technique involves planting crops together that naturally work well with one another and support each other's growth. This is why is got the nickname 'sister' planting.

This technique is believed to originate from Southern Nations. The Mayan and Aztec communities used to trade the three sister crop (corn, bean and squash) seeds with Indigenous communities like the Cherokee and Haudenosaunee. This is also how we came to have corn in North America.

The most common seeds used for Three Sister Planting are corn, beans, and squash. However, there are other crops that work as well. Today this concept is also known as "companion planting." With Three Sisters planting, or companion planting, the seeds chosen to grow together are ones that grow in a reciprocal relationship with each other.

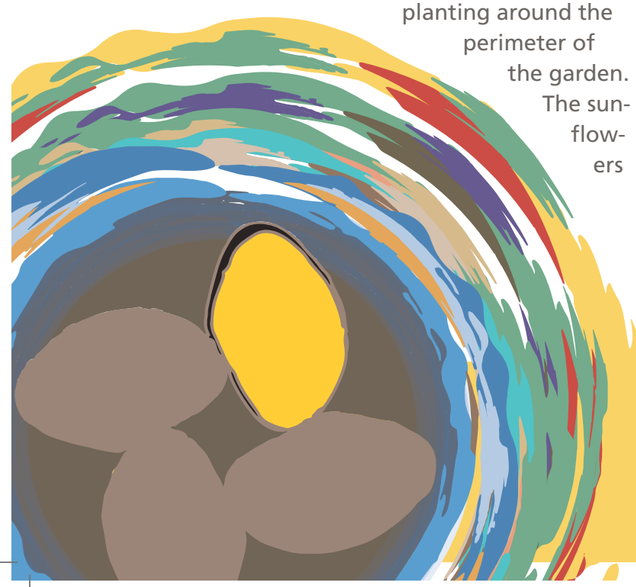
For example, when you use corn, bean, and squash seeds for your Three Sister garden; the beans naturally work to pull nitrogen from the air into the ground, which the corn needs in order to grow, and the corn then supports the pole beans by providing a sturdy trellis for them to climb. The squash is then planted last in order to provide ground cover and help retain water and moisture in the soil.



Haudenosaunee lived throughout the St. Lawrence River, Upstate New York, and Great Lakes Region and are known to have extensively practiced this Three Sisters planting technique. Since Haudenosaunee often lived in large communities, they would use this growing method to grow large amount of staple foods for their people during the good months, and then dry and store some of the crops in longhouses to eat over the winter period.

This growing method was also used by the Anishinaabek. They would plant their Three Sisters differently in mounds along the banks of creeks and rivers. This method technically involved two Indigenous agricultural techniques; the Three Sister companion planting technique, and a form of permaculture because their gardens would then draw on the natural watering system from the river or creek. Similar to the Haudenosaunee, Anishnaabek would dry and store fall crops in shelters to eat over the winter period.

There are many ways to plant a Three Sisters garden. Other traditional crops used with this method were tobacco, strawberry, potato, sun flower, and sunchoke plants amongst others. Sun- flowers, for example, are used for planting around the perimeter of the garden. The sun- flow- ers will work to attract pollinators and provide the birds with seed luring them away from other crops. Three Sister planting is very versatile- different plants and layouts can be used according to availability, space, and preferences.



## Seeds: Planting Preparation

There are many different methods that can be used to prepare seeds for planting in the soil. Some seeds benefit from soaking before planting because it helps them to germinate faster. Soaking softens the seed shell so that it is easier for the plant embryo inside to emerge. Corn seeds can be soaked in water 3 to 4 days prior to being planted. Squash seeds cannot be in water for more than 24 hours. Beans cannot be in water for more than 6 to 12 hours. The seeds are soaked in water so that they can gather enough nutrients, and this helps with their potential for germination once in the ground. Germination means the growth and development of a seed, after being asleep.

## How to Grow with Three Sisters

When you do begin to plant seeds for a Three Sister garden, you want to make sure to plant them directly in soil. Not only do the crops need to be planted this way in order to work with one another, it will also ensure stronger root systems and better water and nutrient absorption.

Traditionally, in the Great Lakes region, the period of time leading up to the Full moon in early June is considered the best time for planting your Three Sister crops.

*Plant sisters in order of: Corn, Beans, Squash. Planting in this order ensures that each plant can grow and mature both individually, and together, without disrupting the growth of another. Sister Corn is planted first in order to begin growing its stalk for the beans to climb. Sister Bean is planted a couple weeks later, or when you notice the corn stalks are at least a few inches tall. The beans then pull nitrogen from the air and redistribute it back into the soil, which provides the nutrients that the corn needs to continue growing healthy. Sister Squash is planted last so that the large leaves do not shade the other seedlings from the sun while they are trying to grow. It is best to plant Sister Squash at least a week after beans have emerged. The squash will then provide ground cover, protecting the other crops, and help to retain moisture in the soil as all of the plants grow together.*

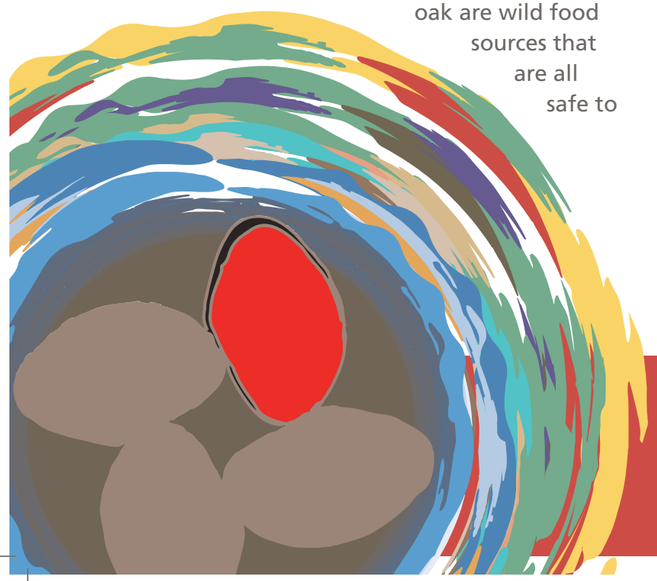
# Summer

*Summer is located in the southern quadrant of the Medicine Wheel. The south is where everything is thriving and awake. This is where the middle of the day is found. This stage of life is Youth - not quite an adult but not a child either. It is when we learn how to take care of ourselves and find balance. The sacred medicine of the summer is sweet grass. When burnt, the smoke it produces protects us during hardship and difficult times.*

A time for Gathering, and tending our Soil

## Wild Edibles: Sustainable Selections

There are many food plants that grow all around us which can be gathered and consumed. The practice of gathering these foods is often referred to as 'foraging' but can also just simply be referred to as gathering wild edibles. If you are a foraging beginner, it may not feel like an easy task to start learning how to recognize all of the wild foods that are found in abundance around us, however, with a little bit of time and research, there are some easy tips that can be followed in order to gain this valuable knowledge - and keep it. A good way to begin is to simply choose five plants you want to learn about. Next, set a goal to learn all you can about these five plants in the next twelve months. The following year, another set of five plants can be chosen. Not only will learning about these wild edibles in smaller sections help ease the learning process, you'll be surprised at how many plants you will become an expert in, especially when you make this a goal every year. To begin your learning journey, consider gathering some of the most common and sustainable wild edibles that are likely already found in your surroundings. For example, acorn, maple, and oak are wild food sources that are all safe to gather in large amounts. Other foods to consider finding are wild rice (Great Lakes' Manoomin Wild Rice), Paw Paw trees, sunchokes, and berries such as strawberries, and raspberries. Wild rice is usually found around the Great Lakes because it is only capable of growing in water. Although the Paw Paw tree is not seen or used as often due to a small gathering window, it is a very delicious and a natural food resembling a 'banana-custard' taste. Wild strawberries and raspberries are an easy food to identify for beginner foragers as they are so similar in appearance to the supermarket varieties.



While learning about edible plants, it is crucial to note which plants are at risk of being overharvested so that you do not contribute to this unsustainable practice. One example is the Chaga mushroom. The chaga mushroom is technically a parasitic fungus found on birch trees. Although it is considered very healthy antioxidant for humans, it is not a sustainable food source because it grows in small amounts and takes decades to grow.

## Mycorrhizal Systems & Mycelium Fungi

Speaking of mushrooms, one of the most versatile fungi that deserves some more attention is Mycelium. Mycelium is special because it is one of the most sustainable edibles that can be grown. Not only does it have a very rapid growth rate and can grow within hours, but any waste that it produces can also be composted. While it is similar to yeast, since it is also a fungus, the main difference is that Mycelium is multicellular, meaning that it can grow more complex structures. Mycelium pulls its nutrients from wood and plant waste, then begins to grow long microscopic fibers into a network. Once this network has been formed, it can begin building a mushroom. Mycorrhizal and mycelium mushrooms are like an underground tree, a nervous system that communicates between plants. Mycelium has been likened to a telephone line between plants. Mycorrhizal systems benefit many shrubs and trees in garden. The system helps trees grow, specifically fruit trees. So in your yard, grow for example wine cap mushrooms! They can transform clay to 2-3 feet of top soil in a few years.

Fun Fact: Today, Mycelium, the intricate network-which is the mushroom support system that forms prior to the mushroom, the fruiting body, actually appearing, has already gained scientists' attention. Mycelium is currently being studied for its potential in biofabrication and if successful, could transform the way we produce many of our products such as packaging, plant-based meat, clothing, and much more in the future.

## Recognizing Soil Health

Healthy soil is typically dark grey, dark brown, or dark black, with a bit of red colour that may come from rotting wood. Dark colour is a good indicator of healthy soil. On the other hand, a light, yellow-tan colour is usually a sign of very dry or dead soil. If this sounds like your soil, take notice if there is too much clay or too much sand. Colour is a helpful indicator of your soil health. Clay-heavy soil interrupts proper water movement and root growth due to its high density. Clay does have benefits for certain things, for example, it can hold a lot of water which grass tends to grow very well in. However, other than grass, trees and some viney plants, too much clay in your soil is not good for growing most other plants. Sandy soil is the opposite, it does not retain much water or nutrients, and instead has too much drainage which makes it unsuitable for growing most crop plants.

## Regenerating your Soil

Soil is one of the most crucial components of growing food, so it is important to know how to maintain and repair it when needed. First, it is important to maintain a good consistency, meaning that the soil should not have too much sand nor too much clay content. Healthy soil usually consists of an equal amount of both sand and clay, as well as organic matter. Balance is key. This can be a simple fix on a small scale: if the soil looks too sandy, add more clay. If there is too much clay, add more sand.

Once you have established this balance, you must then consider nutrients. Neither sand or clay have much nutrient content, so you will need help from other elements to produce good soil. Just like us, plants need food, water and sunlight to survive. Luckily, the food nutrients your plants need can be as easy to produce as giving them your own food scraps. This is where composting comes in to help. Compost can be created using

many different methods. It is simply the process of creating organic matter ingredients for your plants to eat. You can choose to create compost with your food waste from your kitchen, with worms, wood chips, or mixture of all of the above. There are also a few different methods to choose from to get started, ranging from slow and low-maintenance to fast and high-maintenance.

## A Note on Soil Repair

While repairing or building the soil, you can still grow plants. Consider growing your plants using a bucket system or in raised garden beds since the garden soil is not ready for use while it is being built or repaired.

## Vermicomposting

Using worms to create compost is called 'Vermicomposting. Vermicomposting can be done in storage containers that can be kept in a home basement. The worms will eat the food waste you put in their container and produce worm castings (a.k.a worm poop!). The worm castings create a soil full of microorganisms and this can improve the soil quality very quickly.

## "Cold Rot" Composting

If you don't have the extra time or human power to tend to your compost, a more long-term method to consider is 'Cold Rot' composting. With this method, you simply build a pile of compost, leave it alone, and then in 1 or 2 years you will have really good soil.

However, because this is a slow composting method, you want to be careful to only add plant matter. Cold rot composts cannot have dairy, or any form of animal waste. This is because if it is not rotting fast, it will attract animals. Otherwise, this method is good if you are looking for low-maintenance. Simply plan to turn it once in a while, to move the nutrients around. This allows air into the compost and prevents any mould from taking over.

## "Hot Rot" Composting

If you do have the time and human power, Hot Rot composting is a very quick way to produce healthy compost. Hot Rot is another way to describe Thermophilic Composting. Like its name suggests, Hot Rot composting gets very warm - this is due to bacteria. This type of composting can create ready-to-use nutrients in as little as 2 weeks to 1 month. In addition, where the Cold Rot method can be strict in only having plant matter, the Hot Rot method is much more inclusive of food waste and scraps.

If you use this method, you will need to plan to turn the compost every 2 days. A tip Caleb shared is to use a tarp to move it around and then throw back into its designated bin/space. Although not necessary, it would also be helpful to get a compost thermometer, which is simply a longer thermometer. Hot rot begins at 135 Fahrenheit (60 degrees Celsius), and it likes to be between 145- 165 degrees Fahrenheit, which is 65-80 degrees Celsius. Beyond 160 degrees Fahrenheit it can get too hot and this can prevent the bacteria from forming your compost.

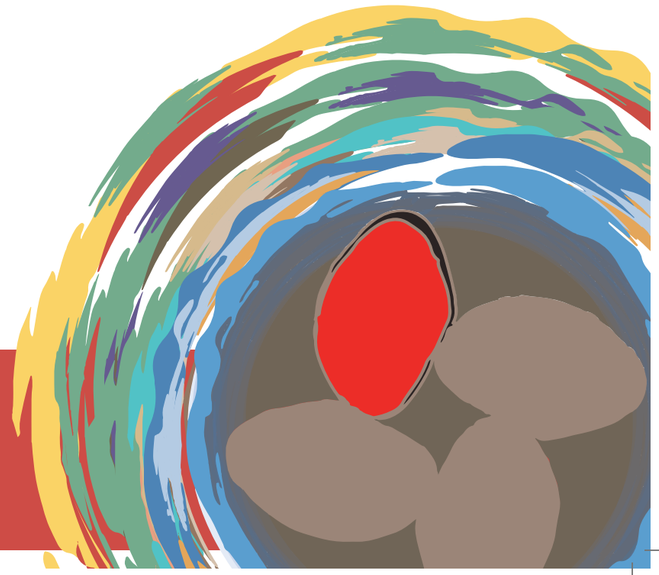
## The Bokashi Method

This method of composting that can be used if you prefer a fast process, but on a smaller scale. The Bokashi method originates from Japan and can be done in your own home. It is a bucket system based on fermenting. Typically you would order a Bokashi compost kit which is usually a 5-gallon bucket with drain holes and a sealable lid. The kit comes with a grain inside (like barley, spelt or wheat) that has already been inoculated with a bokashi yeast. Inside the bucket you would layer food scraps and Bokashi grain separately on top of one another, about 2 inches at a time. Once it has filled to the top of the bucket, you would then place a weight on it, so liquid does not get pushed down but instead floats above. In as little as 2 weeks the yeast will have taken over most of the food scraps through a fermentation process. It will look mouldy green, but not to worry, this is a healthy beneficial yeast. At this point you can then bury the mixture outside and within about a week the majority of the food scraps will have disintegrated. Just remember, fermenting is a smelly process, so it's best to only open the container outside. Some food for thought: Fermenting is a controlled rot and rot is an uncontrolled fermenting.

## Natural Fertilizers

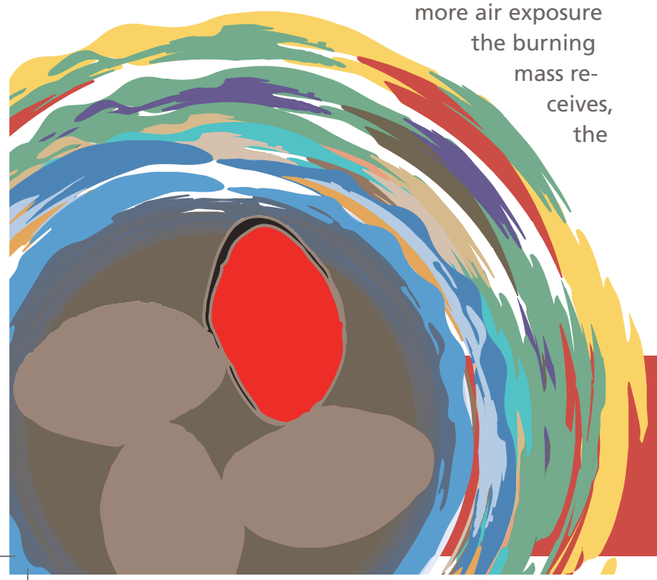
To further improve the health of the soil, it is important to fertilize it. One of the best natural fertilizers is  aged animal droppings. In particular, using duck droppings is often more convenient because ducks produce a lot more droppings than many other animals. Additionally, the quality of this type of fertilizer is significantly higher due to a near ideal ratio of NPK (Nitrogen, Phosphorus, Potassium) nutrients, which are very beneficial for plant growth. Duck droppings also have a watery consistency that is both easier for dispersal and safer to apply directly onto the garden without harming the plants. Another bonus is that you don't have to collect the droppings - they are applied to the soil naturally as the ducks wander around the garden, eating garden pests and fertilizing as they leave their droppings.

Another excellent natural fertilizer is fish offal (or guts), which are a great addition to the compost bin. Fish offal is approximately 80% water and so is capable of decomposing quickly. They are also very nutrient-rich which are favourable for garden soil. A third example of a readily available fertilizer is dead leaves. Every fall, after most of the leaves have dropped to the ground, gather them and save them for the next growing season. Then at the beginning of the growing season (as well as at the end) the leaves can be spread onto the garden to promote nutrient absorption.



## Biological Charcoal Or "BioChar"

In addition to spreading dead leaves onto the garden, turning them into charcoal is another useful fertilization method. This type of charcoal is commonly referred to as 'biochar,' which is short for biological charcoal. Biochar is created from burning plant matter. Charcoal has been used as fertilizer for centuries, specifically Terra Preta, which is the Portuguese word for 'black soil.' This type of soil was artificially made by ancient Amazonians, which is why it is also known as 'Amazonian Dark Earth.' Their ancient technique was so successful in creating rich and fertile soil that it is still being studied by scientists today. Since Biochar is created using fire, it is important to be safe and only use this method under supervision of an adult, or to discuss this method with your community to do as a group. If you decide to use the Biochar method, it is recommended to do a little more research before hand so that you are aware of how to proceed safely. When turning the dead leaves and the dead trees into biochar, they must be burned in a well-ventilated area as well as in an enclosed container, such as a barrel, so that there is limited air exposure. Otherwise, the more air exposure the burning mass receives, the more unusable ash there will be at the end of the burning process. The trick is to hose it with water before it turns to ash. The benefits of biochar can be profound for your soil. Once you spread it onto the garden, it will begin improving nutrient and water retention, air circulation, and lower the acidity levels in the soil. Aside from spreading directly on the soil, biochar can also be mixed in with compost. When done this way, biochar absorbs the nutrients and vitamins from the compost and then provide them back into the soil so that it can hold on to the nutrients from the compost, and release it when the plants need it.



## No Till Methods

One of the problems with tilling is that it compacts the soil and cuts off the oxygen supply to the microorganisms and other life below ground. Healthy soil is comprised of many microorganisms, all of which are needed in order to grow food. When there is too much tilling these microorganisms are essentially killed, which creates the need for artificial fertilizers in order to 'make' things grow. In addition to harming the microorganisms, scientists are starting to learn how tilling interrupts the natural process of carbon sequestration, where carbon is pulled from the air and stored in the soil for long periods of time. Tilling has the opposite effect, it instead releases all of the stored carbon back into the air which is not good for our environment.

## "The Ruth Stout Method"

The story goes, that a woman at the farmer's market consistently had the best food and fruit and when asked by fellow gardeners what her secret was, she said: she simply emulated nature, by planting without digging. She would sprinkle seeds on the ground, and put a bed of straw on top and tend to the sprouts as they came up. By doing this, every year her soil got richer and darker. Straw is a useful ingredient in gardens because it helps to prevent "weeds" from growing as well as breaking down and adding nutrients to the soil. Weeds are considered undesirable because they compete for the nutrients from the plants which are being cultivated.

## "The Hugelkultur Method"

This method originated in Germany and translates as the 'Hill Culture' method. It was a Peasant technique that emerged in a time when aristocrats-controlled ownership of land. The biggest issue at that time was that land was not evenly distributed. Peasants who received one acre of land were required to produce food for themselves, along with the payment to landowners for lending land, and then also had to be able to sell at market. If you can imagine, 1 acre of land to produce all that would be challenging. As the old saying goes, necessity is the mother of invention! The Hugelkultur method involves putting down logs that rot fast (such as birch, aspen, poplar, willow - not oak or cedar). From there, it is a matter of piling brush and shrubs on top and tossing in some soil, straw and grass to form a mound. Overtime, the mound starts to rot, creating a soil rich in nutrients. Hugelkultur mounds can be up to 9-10 feet tall and makes great use of a small space in a way that has huge potential for growth. Another bonus is a reduced need to tend to the garden, because there are less weeds using this method and the soil is so rich in nutrients.

## Maintaining your Soil Triangle

Sand, clay, and compost are the ingredients for your soil triangle. Maintaining the proper ratio of these elements on a regular basis is essential to keeping your soil healthy. This can be done with wood ash toppings in the spring on top of your soil and lining beds with straw mulch to protect young sprouts, which also helps regenerate new soil next year. Remember, plants will take nutrients from the soil (for example, corn takes a lot of nitrogen) so knowing what nutrients your plants needs is also essential. A bit of further research is required to learn more about the proper proportions for the soil triangle ratios, but this is what will help your plants grow well.

## Protecting our Future

During our project, this old Greek proverb was mentioned for us to think about: '*a wise man plants trees that he will never enjoy the shade of.* ' When we think about planting trees and building richer soil, we need to keep this proverb in mind, because both US and Canadian experts say that we have roughly 60 years of optimal growing and soil left. Tending to the soil on the land we are living, ensures that those inhabiting these lands in the future, will have viable soil.

# Fall

*The western quadrant of the Medicine Wheel is where fall is found. Sometimes called the "Berry Stage," fall is when the life that began in the spring has ripened and is ready for harvest. The stage of life found here is Adulthood - this is the "end of the day" time. The sacred medicine of the west is sage. When we smudge with sage, the smoke cleanses our minds so that we are able to find balance before our final journey.*

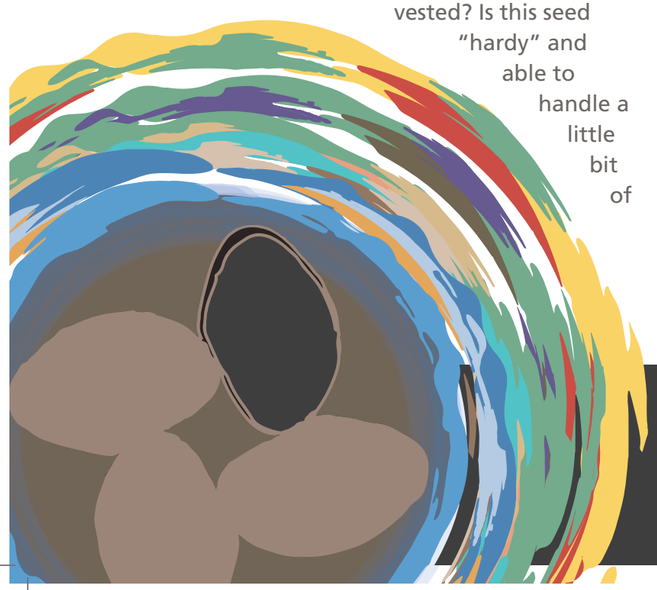
A time for Harvesting and Collecting Seeds

Although many fruits and vegetables have varying growing seasons, the general annual time-frame for most gardener's to begin planting their seeds is the last week of May. However, there are some types of vegetables that can be planted even earlier as they are able to tolerate colder temperatures, (for example, beans, broccoli, cabbage, cauliflower, kale, leeks, lettuce, mustard, and spinach) and there is also the option to plant in the fall, in preparation for another fall or spring harvest.

For this reason, it is good practice to do a little research before-hand on the vegetables varieties you would like to grow so you can plan your planting dates according to what will work best in your region. For example, we learned that calico flint corn is great for growing in regions that get very cold because of its low water content. The lower the water content, the more resistant it becomes to freezing.

## Calculating Planting Dates

When calculating planting dates for a fall harvest, you want to ask yourself a few questions first: When will the plant be finished growing and when will it be ready to be harvested? Is this seed "hardy" and able to handle a little bit of cold or is it susceptible to frost? It's helpful to check the seed's "days to maturity" length and measure this against the length of your growing season.



## Helpful to Remember:

Perennials are plants that grow back and reproduce every year, for example, sun chokes are perennials. Annuals are plants that do not grow back every year, for example corn.

Making sure when planting, that you are mindful of the spacing between each plant as this helps ensure they will have enough room and will not suffocate one another competing for nutrients. Most plants need at least 6 inches to a foot between each seed for optimal growth. Squash for example, needs at least 3-4 feet between each seed to grow.

## Planting in the Fall

By the time fall has arrived, most plants have completed their growing cycle and are ready to be harvested. By this time, new seeds have been formed and are ready to be dispersed. The new seeds are then scattered far and wide through wind, water, wildlife - often in combination - then naturally nestle back in to the earth where their life cycle begins all over again. If you think about it this way, most plants actually "plant" their own seeds in the fall, so it makes sense that seeds can be direct-seeded by us in the fall for a fall harvest. The trick is to make sure you plant it early enough. You want to be able to harvest your crop before the winter frost begins, or else you risk losing your harvest to the frost. To achieve this, seeds should be planted near the end of summer.

Another reason you would plant in the fall is in preparation for a spring harvest. This technique gives the plant plenty of time to grow (+6 months). This extra grow time helps to establish roots, and lets the plant store energy before the springtime. This method is said to yield far better fruit and vegetables in the first spring.

## Benefits of Fall Planting

Whether you are planting your seed in the fall for a fall harvest, or planting your seeds in the fall for a spring harvest, planting your seeds in the fall has many benefits. One of the main benefits is that the soil is already warm but the air is also cooling, which is the perfect recipe for fewer pests! In general, the benefits are less stress in almost every area of planting worries: less insects, less heat, less watering, and the temperature is just right, creating warm soil but cool air.

Fall's cooling temperatures naturally bring more rainfall to the plants, and the soil is better able to retain moisture while the temperature is cooler. During Fall insects are out much less, leaving plants be so they can focus on growing instead of repairing and replacing damaged roots and leaves. As well, the former summer months have now warmed the soil, stimulating the plant's root growth and creating optimal conditions for vital microorganisms. The cooling air temperature then supports the new growth by also removing the heat-stress that often comes in the summer time.

## Fall Seed Saving

When it comes to seed saving, it is always good practice to keep a planting journal or calendar, to know which plants you have, and to record their progression to maturation so you know the best time to harvest both your food and your new seeds. Important things to consider include what types of plants you want to grow, and if they require a lot of sun or partial shade. Keeping in mind that some seeds will be more sensitive to different environments and temperatures. When the time comes for seed saving, you must wait until the plant is overly mature and ripened, to pick out the very best and most viable seeds for saving. This is an important step of the planning process, and it will help in the years to come. The seeds you will want to save, are the ones from plants that you know can thrive where you are. Labelling your seeds is also very important.

## Seed Drying Basics

Once you have selected your seeds you want to save, the first and most critical step is to ensure that all seeds are completely dry. If they are not completely dry, and they are stored, they will likely mould. Seed drying helps to reduce seed moisture, which increases the viability and resilience of a seed in storage. Improperly dried seeds are prone to rot and spoilage. We learned a few tips on how to do this with

squash, bean, and corn seeds which we will share here to help you get started. For drying squash seeds, the process involves soaking the seeds in a bowl of lukewarm water, and then removing the squash pulp to ensure you are left only with the seeds. From here you would distribute them evenly and spread out on paper towels. This process takes about 7 full days for the seeds to dry. In some cases, it may be better to use a plate instead of paper towel, as there will be less likelihood of the seeds sticking to the plate. If neither paper towel nor plates are available, you can use an envelope (light enough so that the seeds can still dry) and then simply label it. When it comes to beans, you can leave them to dry for about 4-6 weeks. You will know they are ready once you hear a clicking sound while the beans are shaken around. Another way to test their dryness, is to put them in a container, and then put a piece of paper in for a minute and see if the paper comes out wet. Lastly, when it comes to corn, you want to let the corn stay on the husk until it turns yellow and dry. It is best to hang the corn so that the kernels can dry faster or attach all the cobs together on a pole with an elastic.

## Seed Labelling

It is also just as important to label your jars, so that you can identify which seed is in which jar. To do this, it is recommended that you keep a journal on hand with all the notes and information regarding the seed you kept, so that you can keep track of your varieties. The jar labels should include the following information:

- *The variety name,*
- *The Nation of origin of the seed (part of the history),*
- *The year you gathered it,*
- *The pollination method,*
- *Where the plant was grown,*
- *Days until it was fully grown (date of maturity),*
- *Planting instructions (how to care for it),*
- *An optional story about the seed.*

## Squash & Corn Species:

While you are taking notes in your journal about the seeds you are keeping, considering writing a little history and/or helpful information to remember about that particular seed. You will be surprised how much you will learn! For example, we learned a little history on the origin of squash and corn and found it very interesting. Using squash and corn as an example, here's some optional notes about these seed species that you could write in your journal:

Maxima squash originated from South America and it is the most common type of Indigenous squash. There are multiple varieties of Maxima squash, which allows them to cross-pollinate with each other. Some examples of the types of Maxima squash that can cross-pollinate are Turban squash and Indigenous gourds.

Another common squash is called the Pepo squash, some examples of which are pumpkin and zucchini. Pepo squashes are considered summer squashes, meaning that they must be harvested in the summertime before they are fully mature since at this stage, the flesh and sometimes the rind are still soft and edible.

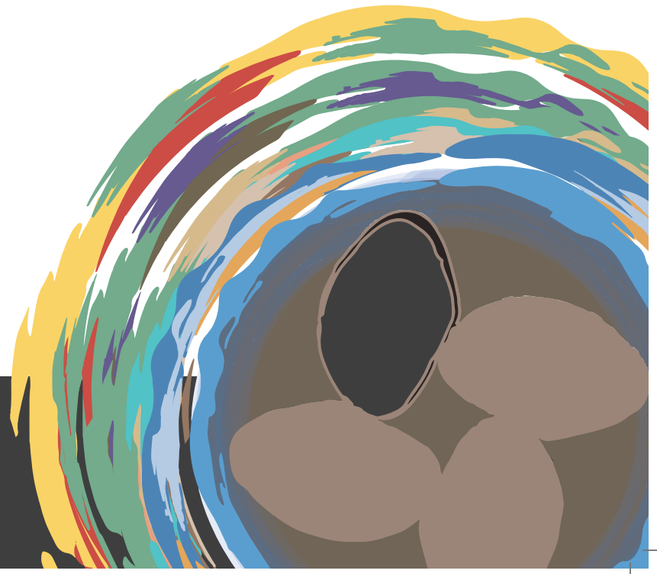
Corn was first discovered in Mexico and has been around for thousands of years. Its long history has meant that it has had plenty of time to be modified. Today, there are many varieties of corn species, such as the popular sweet corn you find in most grocery stores, which is actually a Genetically Modified Organism (GMO). Something to remember about corn species is that they are also capable of cross-pollinating since wind can function as a natural pollinator and send the pollen from one crop to another. This happens because a grain of pollen will attach itself to a strand of corn silk and travel down the tube of the corn silk. Eventually, it will arrive in the ear of the corn and form a single kernel.

## All About Pollination

Over millions of years, plants have adapted to grow without human intervention. Indigenous agricultural practices use this natural process in order to grow crops in conjunction with nature. Open pollination is a process that is sometimes referred to as self-pollination and involves pollen-producing plants exposing themselves to natural pollinators, such as birds, insects, wind, and animals. Indigenous Peoples have learned how to assist pollen-producing plants since these plants are in need of pollinators to grow robustly. Pollen is plays a big part in a plant's reproductive cycle; therefore, if there is ever a need to avoid open pollination and reduce the reproduction of a certain plant, staggering hand pollination is a useful technique because the plants will be at different stages of life throughout the growing season. This means that once a plant is ready to pollinate, another plant will not yet be ready for pollination, which will reduce the amount of crop being ready for harvest at one time. Flowers are one of the main ways that plants have adapted to open pollination as they can attract pollinators with their scent and colour. One example of this is the large size of the flower found on the corn and squash plants.

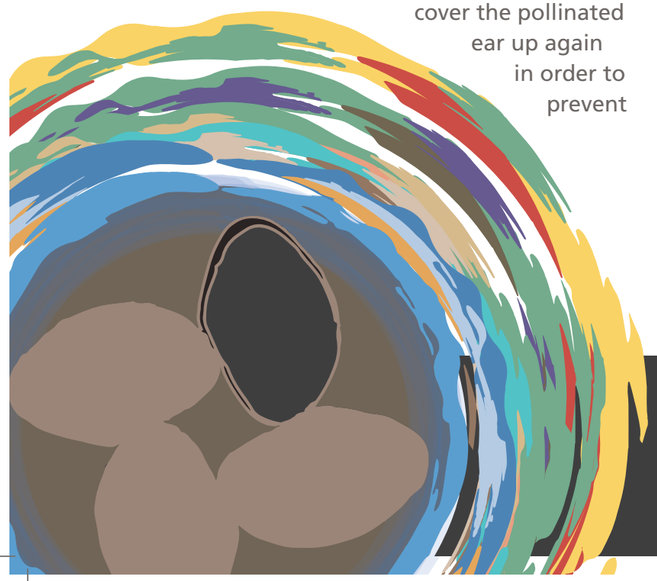
## Cross-Pollination

As plants have adapted to allow natural pollinators to transport their pollen, birds, bees, and other animals often contribute to a process called cross-pollination. This occurs when pollen from one type of plant pollinates another type of plant, creating offspring of a completely new type of hybrid plant. Sometimes cross-pollination can produce a hybrid variety, which is a new type of plant, the seeds of which can later be collected and replanted.



## Controlled Pollination & Hand Pollination

In order to make sure that new varieties of plants are not produced through open pollination, the pollination process can be controlled through hand pollination techniques. This way, the seeds will remain pure as they are grown from pollen that comes from their own species. In the case of corn, the main tool used for hand pollination of corn plants is the paper bag. These bags are used specifically for their breathability, which is important to keep the plant oxygenated. Before corn silks begin forming on the shoots, a small paper bag is placed over top of each shoot in order to prevent natural pollination from wind, insects, or animals, while the cornsilk is still growing. Next, when the cornsilk (or tassels) which hold the pollen, are ready to release their pollen, another bag is used to cover them up and collect the pollen by carefully shaking the tassels inside of the bag, so as not to break the plant. Once the pollen is collected, the small bags can be removed from the now fully developed cornsilks and a small portion of pollen can be spread on top of these silks so it can travel into the ear of the corn and begin creating kernels. It is important to cover the pollinated ear up again in order to prevent further pollination from other species while it continues growing. While the process of hand pollination may seem very elaborate and difficult at the start, there are many resources available to help learners grasp the technique, including asking Elders for help or watching videos online.



## Plant Deficiencies & Issues

There are many tips, tricks, and signs to watch out for to ensure your plants are growing healthy and thriving. For example, young vegetable plants should have shorter stems with many branches and leaves developing early on. If you start to notice plants developing really long and thin stems with few leaves, these plants are becoming too 'spindly' or 'leggy'. This is a sign of imperfect growing conditions, in this case because they are using all of their energy growing upwards to reach the sun, which can weaken them over time and cause them to fall over and break. If you notice this in your plants, consider moving them into better light or investing in a special plant light that can help substitute the lack of sunlight reaching the plants. There are also some common signs of nutrient deficiencies in plants you can watch for, such as yellow or brown leaves, poor flowers or poor fruit formation. In this case, if you are growing food in the soil it would be helpful to add nutrients such as manure or biochar to helps absorb more nutrients.

The following are some common examples of some signs to watch for:

- *When the tips of plant leaves start to turn yellow, it could mean they are being burned from too much sunlight or it could also be "chlorosis" (yellow on plant leaves due to lack of chlorophyll).*
- *When you see yellowing on the plant watch for yellow down the veins of the plant as this is likely to be an iron deficiency. If you see yellow spotting on leaves, this is likely to be a calcium deficit.*
- *When planting tomatoes, sometimes the young ones can become sunbaked if they are out too early, but if you put them in the shade and out of the sun for a few days, then they will bounce back.*
- *When growing tomatoes especially, you want to watch out for mildew build up (which is also known as white powder) on the plant. If you see any, in the long run it is better to get rid of the plant, because it will spread the infection to the surrounding plants.*

## Watching your Soil's Ph Levels

Ensuring your plants thrive may also mean watching your soil's Ph levels, depending on which foods you want to grow. For example, some plants like blueberries thrive in soil that is slightly more acidic - about 4 to 5 on the pH scale. In this case, you would want to add aluminum sulfate to the soil every month to produce healthy and well-developed blueberries. You could also use some pH buffer solutions, to verify the acidity levels in the ground.

## A tip on Wood Chips

During the fall time it's common to see individuals who are cutting wood in preparation for winter. We learned that using wood chips on your soil can be highly beneficial in helping your plants grow. Wood chips insulate the soil and help ensure the soil does not get compacted, which helps roots spread further. Wood chips also help retain water, which is something we want when in a drought. It can also help eradicate any undesirable plants by preventing their growth. To do this, you want to have between 6 to 10 inches of wood chips on your soil, replacing it and adding as much as you can. For the few plants that do survive, their roots will no longer have a strong base because be held by wood chips, rather than the soil, so they will be weak. If you do decide to use wood chips on your food garden's soil, you want to try to obtain the cleanest wood chips possible. Consider asking your parent or grandparent to switch to a vegetable-based oil to lubricate their chainsaw instead of a petroleum-based oil. Not only do petroleum-based oils have negative environmental effects, they are also harmful to the human respiratory system when there is prolonged exposure to oil mist during the cutting process. Vegetable-based oils, such as sunflower oil, can be a beneficial substitute because they are cheaper, more readily available and are safer when inhaling or leaving residue on the skin. In terms of lubrication, they are just as effective and are environmentally friendlier, since the wood chips will not have any chemical residues on them and can safely be added to the soil and your food garden.

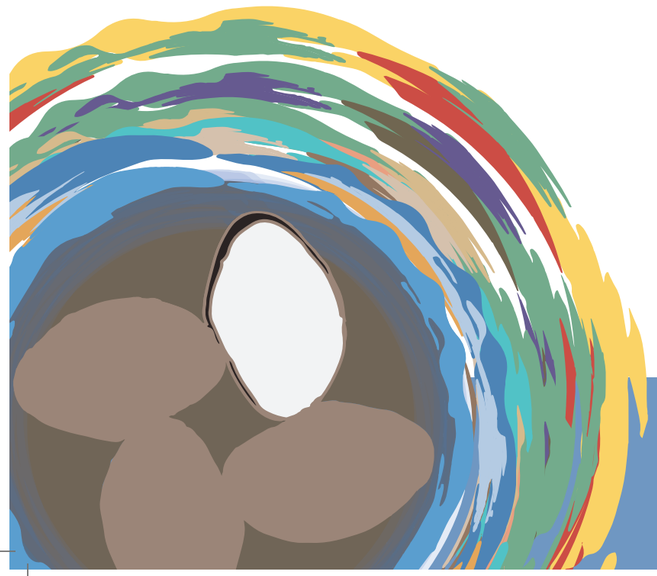
# Winter

*Winter is associated with the northern direction and is a time of quiet reflection. Some call this the period of remembrance. The north is associated with nighttime and with rest. This stage of life is where our Elders and Grandparents are found. From their journey across the medicine wheel - through childhood, youth, and adulthood - we learn from their wisdom and guidance. The sacred medicine of the north is Cedar - it purifies and protects.*

A time to Prepare, an Opportunity to Grow More

## The Future of Food Growing

It was not that long ago that we existed in balance - the water, the air, the plants, the animals, and humanity, thrived  together in an interdependent and sustainable cycle. Traditional land-based knowledge and food systems not only sustained Indigenous Peoples, their families, and the lands – it also ensured that future generations would be able to eat, be clothed, sheltered, and protected. Colonialism disrupted this balance. Today, in the face of climate change, scientists are beginning to recognize how vital Indigenous Peoples' traditional teachings and land stewardship practices are for protecting our planet and ensuring future sustainability. However, as beneficial as these practices are, and even if we were to all begin using these practices today, we will still have to face some of the effects of climate change. For this reason, it is wise to incorporate some other sustainable practices along with traditional methods. Just like we work during the three good-weather seasons to plant and to harvest and preserve our foods, we can also use the fourth, winter season to prepare for the warm months and to continue growing food throughout the cold months.



## What is Hydroponics?

Hydroponics is a method of growing plants without soil, using water, nutrients, and sometimes a substrate. Growing food using hydroponic methods is also called 'Controlled Environment Agriculture,' which simply means that the foods are grown in a controlled environment in an effort to promote sustainable and reliable food production. These kinds of practices are now being used in an attempt to mitigate and solve global food issues. Hydroponics, for example, is extremely versatile. It can be used anywhere in the world, in any city, and in any community. Depending on your community's specific needs, it can be set up to grow food indoors on a year-round basis, or outdoors to extend your growing season longer, both of which produce more food directly for your community.

## Why use Hydroponics?

The most important reason to consider using hydroponics is because of climate change. Climate science warns that we only have until 2030 to cut global greenhouse gas emissions (GHG) in half if we want to avoid the worst impacts of climate change.  Climate change is a global issue that is already starting to affect parts of our world. Eventually, this change will affect every Nation/species on this planet, some before others, but the consequences will reach everyone. The global demand of food production is changing and growing rapidly. This has created a stronger case for hydroponic growing systems. There are roughly 7.8 billion people in the world, with a 25% population growth in the last 20 years. Over 2 billion more people are expected to be on the planet – totalling nearly 10 billion by the year 2050! This will further strain the Earth's resources, which is why the need for sustainable alternative methods of growing are needed.

## "Farm-to-Market" Separation

Something to consider if you routinely buy your produce from a grocery store is how far your food had to travel from where it was grown, until it reaches your home. This is known as the 'farm-to-market-separation' issue. There are a few reasons this can pose a problem. First, consider how much extra strain was put on our already fragile environment to deliver this item to your local grocer. More transportation means increased carbon emissions and this directly contributes to an already unsustainable system. In addition, the greater the distance your food travelled, the greater reduction in the quality, freshness, and nutrition in your food.  Did you know your produce can lose up to 50% of it's nutritional value in just the first week after being harvested? Having a longer supply chain means we have less nutrition in our "fresh food" section at the grocery store. If we reflect on nutrition briefly, it is the key to a balanced and healthy body. Our bodies need nutrients to stay strong and grow.

Our foods need to be grown closer to home in order for us to have access to nutritious food and a sustainable system. It may seem like moving our farms closer to us would be an easy solution, however, this is not always an easy task either. This is because we are also experiencing a greater reduction in arable land. Too often there is little-to-no arable land near large populations of people, which makes it difficult for farms to move closer because they need good arable land in order to grow food.

## Reduction in Arable Land

Another reason to consider using hydroponics is the decrease we are currently experiencing in *good* arable land. Arable land is the type of land needed to grow crops. On a global scale, arable land has actually increased over the past 50 years due to the amount of trees being cut down across the world. However, this is not considered good arable land, nor is it sustainable. The process of clearing land by cutting down forests may open up more land space in order to plant foods, but the removal of those trees actually create more damage to our planet because the trees are no longer there to absorb the carbon dioxide ($CO_2$) in our atmosphere. Remember, there is already too much carbon dioxide in our atmosphere and we need *more* trees to help absorb this $CO_2$ so we can begin reversing the effects of Climate Change, not less! On the opposite side of this issue, in the regions where good arable land does exist, the arable land is decreasing. This is happening in the Mediterranean region, which historically has been one of our most consistent areas of food production. Almost half of the world's most populated countries are also seeing decreases in arable land. This means that as populations continue to grow, and  food demand continues to increase, our ability to feed ourselves will become more and more difficult.

## How can Hydroponics help?

Hydroponics can help mitigate all of these issues because it is versatile and can be set up in almost any environment. This is an ideal technology to use in areas where there is little-to-no arable land, poor soil, or poor growing conditions. Hydroponics is also a huge water-saver in comparison to traditional food-growing methods, saving sometimes up to 90% (or more) in water consumption because it recirculates the water it uses to grow food. Since this method of growing is most often done in a controlled environment, rather than in the elements, it also uses little-to-no chemicals, fungicides, or pesticides. Also remember, whether growing food with, or without hydroponics - growing your own food near you ensures you are obtaining the maximum amount of nutrition in your food and helps to reduce carbon emissions from the short distance your food now has to travel.

## Choosing a Hydroponic Method

Since hydroponics is starting to become a popular alternative method for growing food sustainably, there are now quite a few different methods in existence today that can be used to grow food this way. If you are a beginner trying to figure out which hydroponic method would work best for you and your environment - an online search can quickly become overwhelming! For our project, we decided to learn about the four most popular hydroponic methods on the market in order to figure out which method, or methods, would work best for the environment in which we wanted to grow. We chose to learn about the Nutrient Film Technique (NFT) method, the Ebb & Flow method, the Deep Water Culture (DWC) method, and the Drip method. The following is a glance at what we learned to help guide you in your own decision.

## Nutrient Film Technique Method

The Nutrient Film Technique - or NFT, for short - is a hydroponic system that is usually set up on an angle so it can use gravity to help recirculate water and nutrients on the plant's roots. This method commonly uses "net pots" to hold and grow the plants while nested in a plastic gutter. At the bottom of the gutter there is a sponge that plants use to absorb the water, which then feeds the roots. This helps the roots to not become too soggy. Most commercial growers use the NFT method because they are reliable and can produce food on a large scale. NFT is especially good for growing leafy greens such as lettuce, basil, mint etc.

The materials required for an NFT are relatively inexpensive but there are a couple things to remember in order to ensure it is set up properly. First, make sure to purchase an aquarium pump to go with it because this filters the water. When searching for the right aquarium pump, check to make sure the pump can be submerged in water and look at the head height (i.e. how high a pump can push water upwards) and the run. Both of these are important. The head height indicates how high water can be pushed upwards before it turns itself off and if the run is too long, the pump will not have reliable pressure. Also make sure to have a hose, so that you will be able to move the water around. Lastly, you will need a sump-tank in order to hold the water.

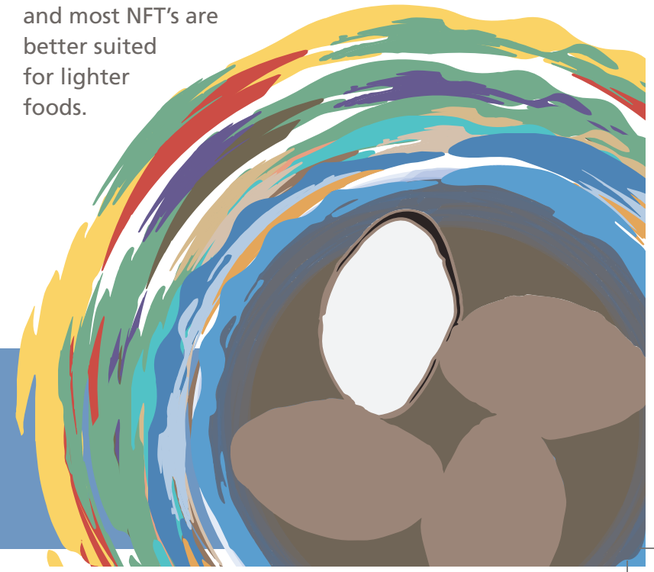
## Ebb & Flow Method

The Ebb and Flow method has a lot of similarities to the NFT method except it is on a flat surface, not an angle - this type of set up allows the water to travel directly through the pump. Whereas NFT systems are usually set up on an angle in order to use gravity to feed the plants. Like the NFT, Ebb and Flow systems also have holes at the bottom of each "net pot" (or bucket) where plants are able to absorb the water and nutrients. Since it is not set up on an angle where it can be gravity fed, Ebb and Flow systems instead use an irrigation line to move water and nutrients towards each plant's roots. The irrigation line then drips the water/nutrient mixture on the roots, the roots absorb the mixture, and excess drains back into a PVC (thermoplastic material used for plumbing applications) return line where it is fed back into the sump tank through gravity. The sump pump then pushes this mixture back through the drip irrigation lines where the process starts all over again. In this system, it is ideal to grow "stringy" or heavier plants such as peppers, tomatoes, and beans.

A popular hydroponic system that uses the Ebb and Flow method is the "Bato Bucket" system, also known as the "Dutch Bucket" system. These are considered fairly easy to set up, you would just need a few supplies to start. First, you would need a reservoir in order to hold your water, a bucket to grow your plant, and a sump pump which you would place inside the water reservoir. You will also need a PVC line, that enables the water to go back to your pump and recirculate to your plant. In each hole, there should be some sort of plug (just in case there is any dirt or debris from the plants) so that it does not get clogged. Bato Bucket Systems use clay pebbles instead of soil to grow the plants. Clay pebbles are used because they make sure the water reaches the roots. If you're not sure which clay pebbles to purchase, one brand that was highly recommended to us during our project was "Hydroton" pebbles.

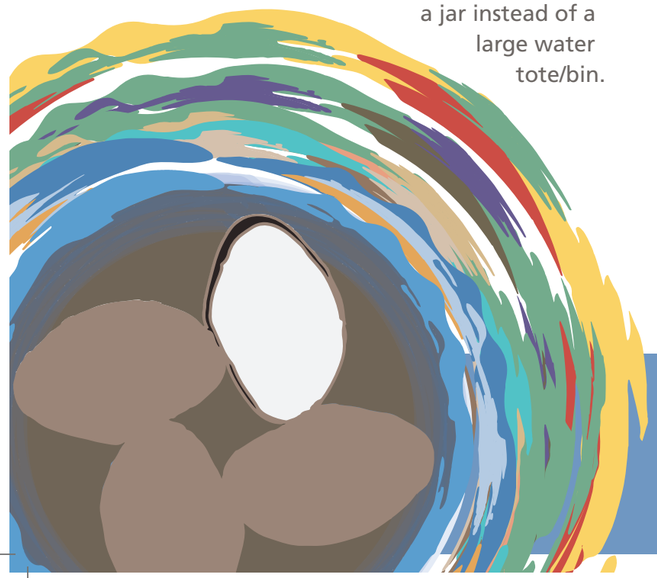
## NFT and Ebb & Flow Methods

Both of these hydroponic methods are "closed-loop" systems, which basically means they continuously recirculate water. In comparison to traditional farming methods - which typically require continuous watering and can sometimes exhaust water resources - "closed-loop" hydroponic systems can save you up to 95% of water usage. This makes them extremely economical and environmentally friendly, as well as long-term sustainable. If you decide to use one or both of these methods, just remember, Ebb and Flow systems (like the bucket system) are ideal for growing heavier foods, such as peppers and tomatoes, and most NFT's are better suited for lighter foods.



## Deep Water Culture Method

Deep Water Culture (DWC) systems are also known as the 'raft system.' In a raft system the roots are left hanging in a nutrient rich water solution, and this water circulates through long canals. DWC systems are basically a tote/bin full of nutrient water that have a light-weight grow bed sitting on top of the water - usually made of a light/foam-like material. The foam bed sinks closer to the bottom of the tote/bin, while the water in the bin slowly evaporates into the air. If you choose to use this method, the evaporation and condensation of the water would need to be closely monitored in order to regulate the air quality and the water levels. There are holes placed at the bottom of the potted plants, so that the roots can dangle in the water, though they do not touch the water much. It is important to note that biomass from the plants holds a lot of heat, so in this method, it is important not to crowd the space by placing too many plants. The DWC method of hydroponics is not recommended for mass production because the weight of the water in the buckets make them very difficult to move around. The "kraty method" is another method similar to the DWC method, however on a much smaller scale: For this, you would grow your plant in a jar instead of a large water tote/bin.



## Hydroponic Consumables

Consumables are items that you will need to continue to buy in order to keep growing food using hydroponics. When you do begin using hydroponics, you will want to check into what type of consumables your system will need so you can be prepared. For example, some hydroponic systems come with their own seed plugs, called "Flexi-plugs" for starting seedlings in. These plugs are relatively inexpensive. The seedling grows in the plugs separately, until it reaches at least 3 inches tall (or their true leaves have sprouted) and then is transplanted into the hydroponic system. By doing it this way, you can minimize the risk of your plant going into 'shock' when it is transplanted. If you don't want to use Flexi-plugs, you can also consider using 'Rock wool medium' instead.

## Liquid Nutrients and pH Meters

Other items you will want to make sure to have are a Ph/EC meter, Ph buffer, and liquid nutrients. Ph meters will help you monitor Ph levels and the amount of liquid nutrients for the plants. Electrical conductivity (EC) spikes measure the amount of salt in the water, and identify the amount of nutrients. Remember, each plant has its own nutritional requirements and optimal conditions for growing, this is why monitoring and verifying these levels are important. Try to aim to use your meters and record your findings every 3 days. It was recommended to us to try to avoid using Ph test paper because it is not entirely accurate.

## General Tips for using Hydroponics

It is generally not recommended to grow root vegetables in hydroponic systems because they often will not survive or grow well. In general, bucket systems are ideal for heavier foods (bell peppers, heavy tomatoes) and NFT systems are ideal for lighter foods (leafy greens, herbs, berries, light tomatoes).

If you have access to two or more greenhouses, consider trying to set up two different 'climates.' Different plants prefer different temperatures, so this will help you to grow even more types of food. For example, one greenhouse could be a "hot house," where you try to maintain the temperature inside at around 21˚C range. In this greenhouse, you could grow the warm-loving plants, like bell peppers, tomatoes, and herbs. The second greenhouse could have normal temperatures, which is ideal for lettuce, herbs, and berries.

Seedlings can be transplanted into hydroponic systems after they have grown for about 2 weeks, or when you see they have 6 leaves. By this time they will usually be around 8-12 inches long. Note that you can also use seedlings that have been started in the soil to continue growing in hydroponic systems, but you must make sure you wash off the excess soil first. They are going to be shocked and sad (for about 2-3 days), but they will bounce back. Continue watering them and make sure the tanks do not get plugged with soil.

## Some Food for Thought

After learning about some of the issues hydroponics is helping to resolve, it may seem like switching to organic produce would be the same as growing personal fruits and vegetables, however, there are a couple things that of reasons that may not be the most ideal option. First, there is often a lack of nutrients in both organic and non-organic foods since many foods lose nutrients due to long transportation periods and a short shelf life. On top of that, the sanitization process of foods often involves bleach water before delivering to grocery stores which may leave potential harmful residue on the produce. Growing your own food means that you know exactly what went into the food, what fertilizers were used, and what processes were employed in growing and handling the food. Whenever you can, growing your own food is the preferred method of healthy food acquisition!

## Tip: Hydroponics to Aquaponics

After some practice with hydroponics, consider one day trying the aquatic method of hydroponics: aquaponics. This set up is very similar, except with the addition of fish! If you do decide to transition from hydroponics to aquaponics, a tip we learned is to use Sucker Fish as your first starter fish. Sucker Fish are readily found in the wild and can be used not only for consumption, but also as a key component in keeping your aquaponic systems working well because they are one of the best algae eaters.

# Conclusion

We hope this guide has served as a helpful introduction to the many ways you can begin growing food both locally and sustainably and inspired you that you too can start practicing some of these techniques. This guide is only an introduction to these topics, we encourage you to seek out Traditional Knowledge Keepers near you who can help you continue this important learning journey. You can also learn more in-depth about Indigenous seeds, traditional Indigenous food systems, foraging, hydroponics, and the connections between our traditional food and the Residential School System by visiting some of the links and resources listed at the back of this book.

Should you wish to gather together with a group to begin learning and practicing these teachings in your own community, as we did with the Chippewas of the Thames First Nation (COTTFN) youth group for this pilot project, consider breaking down the knowledge you learn by season. We found this method to be helpful in learning and remembering how to practice all of the teachings we were being taught. After we learned about these topics we then brainstormed and discussed what was most relevant to them and what could or should be started in their community.

The following is a brief overview of some the outcomes that came from learning about these food and growing-related topics during our pilot project with the COTTFN youth group. Much of what was learned during our short time together has already began to be implemented by COTTFN and there is still so much more that can now begin.

## Spring

In preparation for the Spring portion of learning, the LHF was able to source and collect heirloom seeds, including some Indigenous varieties, in preparation for the youth's learning about this topic. After learning about the importance of these seeds, the youth group in COTTFN were then given the heirloom and Indigenous seed varieties to start practicing how to grow with them. They were also put on the Sovereign Seeds wait-list to receive more Indigenous varieties, once they become available.

## Summer

During this portion of learning the youth group in COTTFN learned about wild edibles, composting, the importance of healthy soil and how to restore it. It was identified that the issue with the soil in their community was that it was too clay-heavy, making it difficult to grow in. They now know strategies on how to begin repairing clay-heavy soil and there was interest in starting plans for community composting.

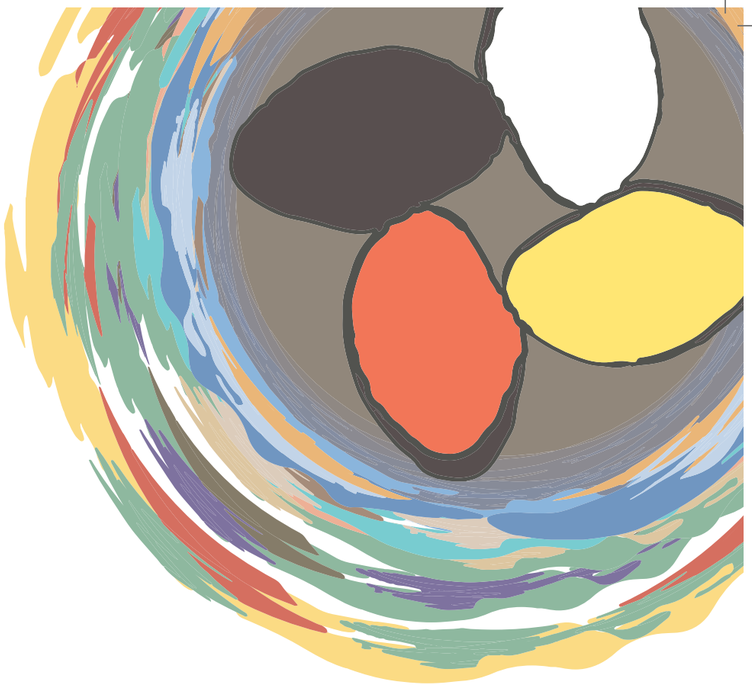
## Fall

This portion of learning connected back to Spring, in it now focused on helpful seed-stewardship practices, how to harvest your seeds, and tips on seed drying and collecting. This knowledge will not only help the youth be able to collect their seeds for the next growing season, our hope is that it will help inspire them to continue being seed stewards of these important seeds.

## Winter

During the winter portion of learning we learned about food sustainablity and how hydroponics can help. With the help of experts, we learned about the four most popular methods of hydroponics in order to make an informed decision on which method could be used in the community. After feeling more confident in the differences between these methods, the youth group chose to use the Nutrient Film Technique (NFT)/Drip Method and the Ebb & Flow method. The hydroponic system brands they used for these methods were ZipGrow Towers and AutoPots.

The ZipGrow Towers (brand name) are hydroponic system that blend the NFT and Drip method. These towers are considered a vertical farming technology because they grow food upwards, rather than horizontally. This meant it would take up less space and could grow more food in a smaller space. Another benefit with this kind of hydroponic system is that it was light-weight and could be moved and taken apart easily if needed. The AutoPots (brand name) are a hydroponic system that utilizes the Ebb & Flow method. These are essentially buckets with a built-in irrigation system to 'drip' water and nutrients on the roots. The AutoPots were perfect for growing the heavier vegetables, such as bell peppers and tomatoes, and the ZipGrow Towers were ideal for growing the light-weight foods, such as various lettuce and herbs. As we learned during this project, both of these kinds of hydroponic methods help reduce water consumption by up to 95% because they work to recirculate the water and nutrients, rather than continuously need new water. Hydroponics were set up both indoors and outdoors. For example, an indoor ZipGrow 'Farm Wall' was set up inside the local elementary school. Students can now watch and learn how food can grow with hydroponics throughout the school year. Outoor hydroponics were also set up outside in multiple greenhouses. The greenhouses used ZipGrow Towers, ZipGrow Farm Walls, and AutoPots. Raised garden beds were set up along the outside.



At the end of the project, the goal was to set up a 'final' local food system which could continue to be used and led by youth. For this, a larger greenhouse was selected. The greenhouse chosen was a growing dome by Arctic Acres (brand name). This greenhouse could withstand high winds and snow because of its geodesic design and blended solar and geothermal technology to be able to grow year-round in Canadian weather.

## The Legacy of Hope Foundation

The Legacy of Hope Foundation (LHF) is a national, Indigenous-led, charitable organization that has been working to promote healing and Reconciliation in Canada for over 20 years. We educate Canadians about Indigenous history and about the rich contributions that Indigenous Peoples have made to this country. We do this through the use of our curriculums, exhibitions, workshops and training, podcasts, research and outreach.

## Sovereign Seeds

Sovereign Seeds is an Indigenous-led network dedicated to supporting Indigenous seed sovereignty in what is colonially known as Canada. We work to facilitate meaningful opportunities for Indigenous people to connect with one another and with our ancestral food relationships. Sovereign Seeds exists to support the revitalization, transmission, and vitality of Indigenous peoples' seeds and seed cultures for the health of our people and the territories we depend on. By cultivating seed education opportunities, collaborative spaces, and tools, we aim to contribute to Indigenous seed efforts by nurturing and strengthening our ancestral seed practices.

## Canadian Bushcraft

Canadian Bushcraft is a First Nation-owned and run wilderness skills company, which offers opportunities for people from all walks of life to immerse themselves in our natural environment. Caleb Musgrave is the founder/owner of Canadian Bushcraft, which operates out of Hiawatha First Nation. Caleb is a Wilderness Survival Instructor, Anishinaabe storyteller, and experienced educator in a wide range of topics, including bushcraft, hunting, traditional Indigenous knowledge and food systems, and more.

## ZipGrow

ZipGrow aims to empower local and sustainable food production with the many advantages of hydroponic crop production. Their vision of a better future looks like: a global attitude of people wanting to participate and contribute - and have equal access - to the highest quality, environmentally and economically sustainable produce possible. Their mission is to design and manufacture the most economically viable, resource-efficient, and productive hydroponic equipment possible for people who believe in smarter, local food sources and want to participate in changing how people think about and access food.

## Arctic Acres

Arctic Acres provides Canada with the highest quality geodesic greenhouses, sustainable horticultural solutions, and innovative living and workspaces. Growing Domes® are state-of-the-art geodesic greenhouses designed for year-round growing - even in Canada. There is officially a Growing Dome greenhouse in every province and territory in Canada. Their exceptional growing capabilities are being tested in a wide range of challenging environments - transforming homes, businesses, and communities towards a more sustainable future.

## Links & More Resources

### Legacy of Hope Foundation

- www.legacyofhope.ca

### Sovereign Seeds

- www.sovereignseeds.org

### Canadian Bushcraft

- www.canadianbushcraft.ca
- Facebook: www.facebook.com/pg/canadianbushcraft

### ZipGrow

- www.zipgrow.com
- YouTube: www.youtube.com/user/BrightAgrotechLLC

### Arctic Acres

- www.arcticacres.ca

### UpStart University

- https://university.upstartfarmers.com

The Legacy of Hope Foundation is a national,

charitable organization whose purpose is to **educate** and

**Create awareness and understanding**

About the impacts of Residential Schools, including

intergenerational impacts on First Nations, Inuit, and Métis

and to **support** the ongoing **healing** process of

**Residential School Survivors**.

We hope to build **empathy**

and respect and inspire

**Positive actions**

by all **Canadians** to foster **Reconciliation**..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