NorthlandInc
Growing Northland's Economy
Kia tupu ai te ōhanga o Te Tai Tokerau

Kaipara Water Demonstration Sites

2022/2023 End of Season Report

For Kaipara District Council

Contents

1 Executive Summary

This report covers the 2022 to 2023 summer growing season from 1 October 2022 to April 2023. The growing season was marked by excessive rainfall, which caused delays in site preparations and planting.

The lead-in to the season was exceptionally wet, making it difficult for contractors to access sites for spraying and cultivation.

Site one located Maunganui Bluff, crops of Delica and T-133 squash. Despite the delays, planting finally occurred on December 19th, resulting in an estimated 4,000 pieces of squash picked 4-5 April and distributed to the community through Te Roroa's networks and the Kaipara District Council. The squash distributed to the community was worth approximately $35,000 in retail value.

The installed irrigation system had a fault, but individual controllers were fitted on each valve which resolved the fault. Soil moisture was monitored using probes, and pest management was minimal, except for tropical army worms and powdery mildew. Despite the unfavourable conditions, valuable learnings were obtained, such as the need for manual or mechanical weed control before runner establishment, plant spacing to suppress weeds, and side dressing or fertigation before the plant starts to run.

The germination was noticeably earlier where irrigation was active on the site. Even though this was an exceptionally wet year the non-irrigated sections did catch up post germination and the crop yields reflect this at harvest. This does show the value of irrigating a crop even post sowing to get that advanced early stage growth development.

Site two located Te Kopuru, crop of sunflowers. The sunflower growing season was also severely impacted by excessive rainfall, resulting in the inability to plant both the normal scheduled late October and shoulder season crop, which was scheduled for mid-December. The entire site flooded during February's cyclone Gabrielle. The site was divided into two 1-hectare blocks, and site sprayed multiple times in October, December, and January, but the ground conditions did not allow for cultivation and planting.

2 Project Background Context

Council has implemented a project to deliver a proof-of-concept pilot to demonstrate practical working examples of irrigating high value horticultural crops in the Kaipara. This will inform landowners, external investors and early adopters about high value land and water use, application of innovative technologies and provide confidence to make a commitment to transforming land (horticultural developments) in Kaipara.

Proving the feasibility of different crops is complementary to work with the Northland Regional Council (NRC) on water user demand and is a critical foundation to support future landowner uptake of water from a future community-based water storage scheme (Northland Water Storage & Use Project being delivered by the Tai Tokerau Water Trust).

The key outcome of this project, linked to the strategic outcomes of the Kaipara Kai project, is a practical working demonstration model to provide confidence and commitment to land transformation to benefit the community and interested parties by:

- Providing a practical working example of irrigating high value horticulture crops in Kaipara.
- Demonstrating the value of water and ways in which it can be used through infrastructure and technology.
- Creation of interest, and a conversation starter for the Kaipara community and in particular Te Kopuru where the large-scale water storage scheme will be located.
- Providing information and education to landowners with a view to give them confidence in water, crop, and irrigation solutions.
- Providing landowners with an insight into the business case for growing high value crops.
- Sharing site development progress and crop growth progress and types through time lapse video that is available to the public digitally.
- Providing opportunities by arrangement between Council and Licensor for members of the public to visit the Demonstration Sites.
- Providing iwi specific facilitation and support in kai development for iwi to build capacity and capability about horticultural opportunities and site development.
- Establishing Site activities that support the cluster development focus of the Kai Hub.
- Establishing Site activities that support the goals of large water storage project, e.g. demonstrating and proving value of water.
- Sharing information and data with Te Tai Tokerau Water Trust (TTTWT) as useful information the TTTWT project can share with landowners in the proposed Kaipara water storage location.
- Providing annual project analysis, that includes cost/benefit analysis, cropping and market projections, to allow landowners the opportunity to make informed business decisions in the future.

3 Project Services

Northland Inc (NI) is providing the necessary personnel, expertise, oversight, and management for the delivery of Kaipara District Council's two Kai Water Demonstration Sites:

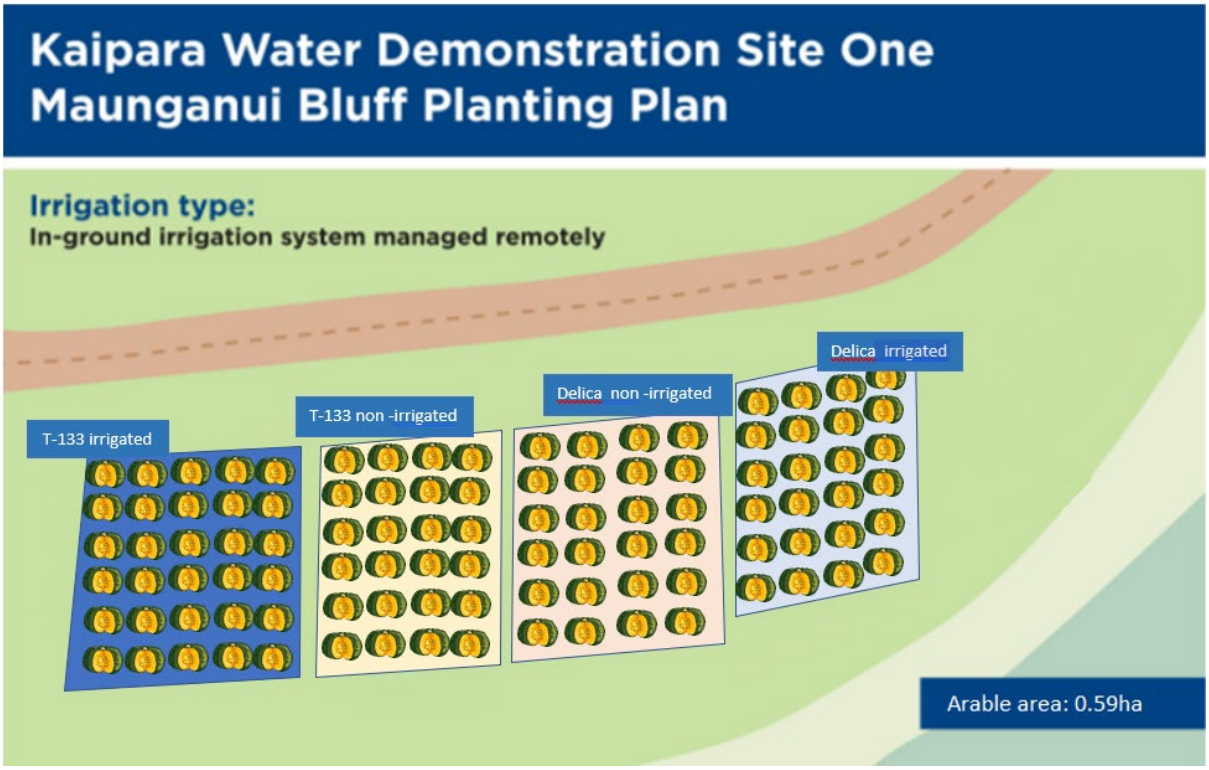
- Site 1 – Maunganui Bluff (Te Roroa property)
- Site 2 – Te Kopuru (Rope property)

4 Site 1 – Maunganui Bluff (Te Roroa property)

Property located at Aranga Coast Road, Maunganui Bluff

GPS: -35.76943902530477, 173.60145336879313

Site arable area 0.59ha



4.1 Season Overview

This year's growing season was characterized by excessive rainfall, which caused multiple delays in spraying, cultivation, and planting of the site. These activities had to be postponed until conditions were suitable, to ensure the crops' best chance of survival while preserving the soil structure and minimizing land damage. Additionally, the natural spring discovered in the middle of the site last season disappeared this year.

Planting was originally scheduled for late October 2022 but was continuously delayed due to the extreme weather events experienced in the region. With time running out, the site was finally cultivated on December 18th, and planting took place on December 19th, just two days within the planting window. The two varieties of squash, Delica and T-133, were planted by Te Roroa using a hand finger planter provided by Northland Inc. The site was divided into four blocks, T-133 irrigated, T-133 non-irrigated, Delica non-irrigated, and Delica irrigated.

Despite the continued wet weather, germination was more advanced in the irrigated sections , and growth was strong throughout the season across the entire site. A field day was held on March 30th, 2023, and the harvest took place over two days the following week, resulting in an estimated 4,000 pieces of squash picked and distributed to the community through Te Roroa's networks and the Kaipara District Council.

While the pricing for growers can vary depending on their agreements with buyers, such as quality standards and the quantity of produce, the price of squash is generally influenced by various factors such as the type of squash, the time of year, the quality, and the demand. For instance, in late April 2023, squash was retailing for $8.99 each in a Tauranga supermarket. However, the squash distributed to the community by Te Roroa was worth approximately $35,000 in retail value.

4.2 Squash Delica and T-133

Crop	Plant	Duration in days	Harvest
Squash	October 2022	110-120	6 March 2023

Delica is a hybrid kabocha squash with wide adaptability and is vigorous with good fruit setting. Fruit is sweet and flavourful, maturing 45 to 50 days after flowering. Best production requires low humidity and moderate temperatures. Weight 1.7 to 1.9 kilograms.

Kabocha is an Asian variety of squash It's sweeter than butternut squash, with a firmer, less watery flesh. It has fewer calories and carbs than butternut squash. And unlike butternut, kabocha squash has an edible rind once it's cooked.

Squash is one of the fastest growing field crops. Squash plants can produce around 11T/ha in about 100 days from planting, Squash is vine ripened and hand-picked between December and June.

In New Zealand, most squash is grown in the Hawkes Bay and Gisborne regions but has been grown successfully in the Kaipara district in previous years. It is exported to Japan and Korea where it is a dietary staple.

In 2018 there were 24 growers producing 88,179 tons on 6642 ha. Returning $58.6 million from exports.

The site needs to be frost-free and have access to a constant supply of water during the growing season. The large soft leaves are easily damaged by strong winds and strong wind can easily damage the fruit through vine rub. However too much shelter can increase the risk of fungal diseases.

Sowing rate: 2.5kg/h direct. Can use maize drill to sow.

Advice can be sought from the NZ Buttercup Council. NZ Buttercup Squash Council – The website of the New Zealand Buttercup Squash Council (wordpress.com)

At present there are no registered squash growers in Northland.

Fruiting vegetables

Squash requires adequate moisture to produce high yields of quality fruit. About 2.5cm of water is required each week during production. On sandy soils, higher amounts of water may be required with more frequent watering (i.e., 2cm twice a week).

Cucumbers, melons, pumpkins, and squash are most sensitive to drought stress at flowering and as fruits and seeds develop. Fruit set on these crops can be seriously reduced if water becomes limited. Irrigation is often reduced as fruit and seed crops mature.

Plant growth stage influence the susceptibility of crops to drought stress. Irrigation is especially useful when establishing newly seeded or transplanted crops. If transplants are used ,rather than direct seeding, irrigation can significantly increase the plant survival rate, especially when soil moisture is marginal, and the evapotranspiration rate is high. Irrigation can also increase the uniformity of emergence and final stand of seeded crops.

Growing irrigated and non-irrigated plots should illustrate the differences in yield.

Pollination

Pollination is achieved by honeybees and wild populations could be supplemented with commercial hives of honeybees or bumble bees. The landowner has commercial honeybee hives on the property, and they would be close enough to supplement the pollination by the natural populations of pollinators.

Planting day 19 December 2022

photo 1 – planting squash using finger planter.

Photo 2 – finished planting and irrigation lines installed by Te Roroa

Squash Progress

Photo 3 – 11 Jan 2023 Squash progress

Photo 4 – 25 Jan 2022 Canopy closure achieved.

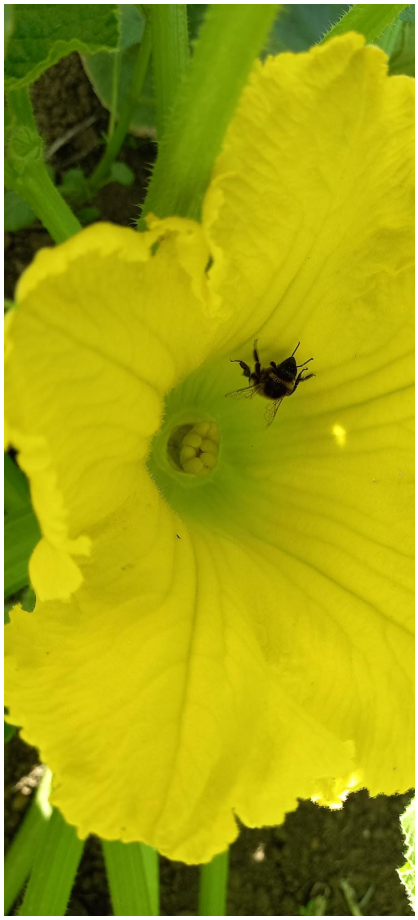


Photo 5 – squash flower

Photo 6 Squash fruit

Photo 7 – Teroroa team harvesting 4 April 2023

Photo's 8 & 9 harvesting team

Photo 10 – harvested squash ready for distribution to the community.

4.3 Irrigation System

The irrigation was installed the day of planting 19 December 2022. Was commissioned then later discovered the controller unit had a fault with it. The irrigation company was advised, found it to be faulty and took it off site for repair. As a stop gap measure, they fitted and programmed individual controllers on each of the irrigation valves however these had no remote access to adjust the programming as required. The site's soil moistures were monitored using the Harvest Monitoring system's soil moisture probes installed across the site.

Cost as at 1 April 2023 of connecting hose and t-tape
T-tape - Netafim strmx 1.05l/h 30cm spacing 2800m roll- RRP $784+GST
Connecting hose – Flexnet 3" x ½" offtake .30m spacing 100m roll- RRP $1359+GST

T-Tape – 16mm in diameter with 30cm spacings between emitters and at 55bar(8PSI) can deliver 340L/100m/hour.

Photo 11 irrigation lines installed and tested

Photo 12 – Irrigation comissioned and providng targeted water

4.4 Pest control

Sites were monitored weekly with a thorough walk through and a hands-on examination of plants. This became more difficult as the weed pressure increased but was still conducted. Tropical army worm was identified and localized to the flowers, once fruit was ripe minimal damage was noticed on the fruit. An insecticide was sprayed along with a fungicide for powdery mildew.

4.5 Weed control

Getting the squash planted was challenging due to the unusually wet conditions in the lead-up to the season. During the winter, the site was clean, without any weed pressures from the previous season. However, towards the end of spring, weed pressure started to increase.

Date	Application	Chemical and rates	Notes
19 Oct 2022	Weed Control/Site preparation	Glyphosate 510 5L/ha Oil 1L/ha Water Rate 200L/ha	
5 Dec 2022	Weed Control/Site preparation	Glyphosate 510 5L/ha Oil 1L/ha Water Rate 200L/ha	
21 Dec 2022	Pre-emergent	Solvo 400ml/ha, Corral 4L/ha and Oil 1L/ha, Lavron 40ml/ha (insecticide which we always put on to prevent bugs) @ 300L/ha.	
16 Mar 2023	Fungicide & Insecticide	Citara 125ml/ha-, Belear 1.6L/ha, Bestseller 200ml/ha- Fertigofol 5.L/ha- @ 500L/ha water, Chemicals can be mixed in same tank mix.	
28 Mar 2023	Weed Control	Glyphosate 510 5L/ha Oil 1L/ha Water Rate 200L/ha	Around the edges of the site

4.6 Fertilizer management

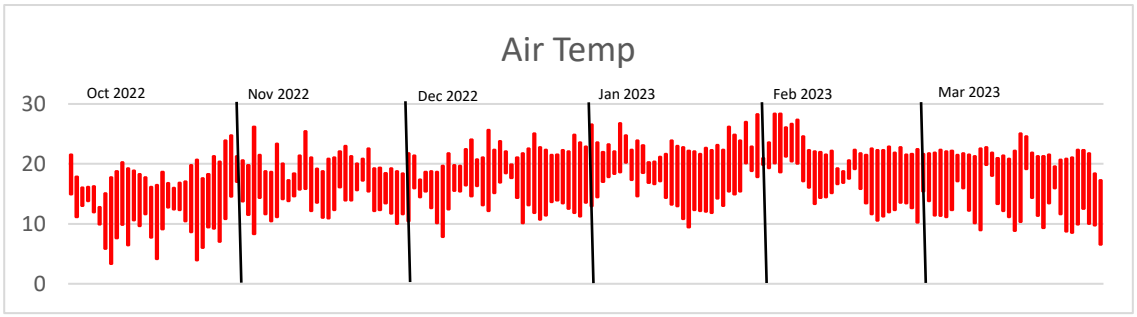
Fertilizer as below was applied to the site 15 November 2022

- Granlar Potassium Chloride @ .110mtr
- Superphosphate bulk @ .7896 mtr
- Flex-n (NBPT) @ .104 mtr

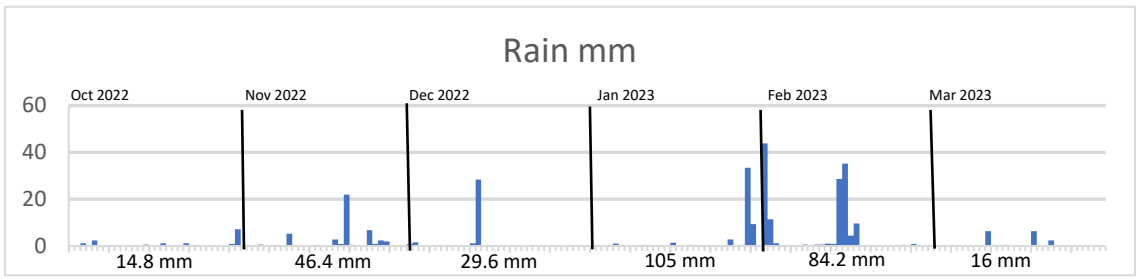
4.7 Monitoring System – Harvest

The site has a Harvest monitoring station attached to the top of the container and soil probes across the site. This measures air temperature, Rain, Wind, ET (evapotranspiration), soil moisture and soil temperature.

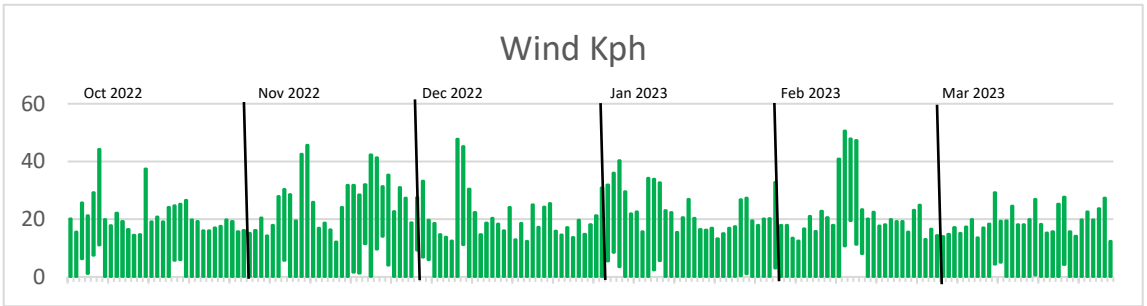
Photo 13 & 14 Harvest weather station and ground soil probe

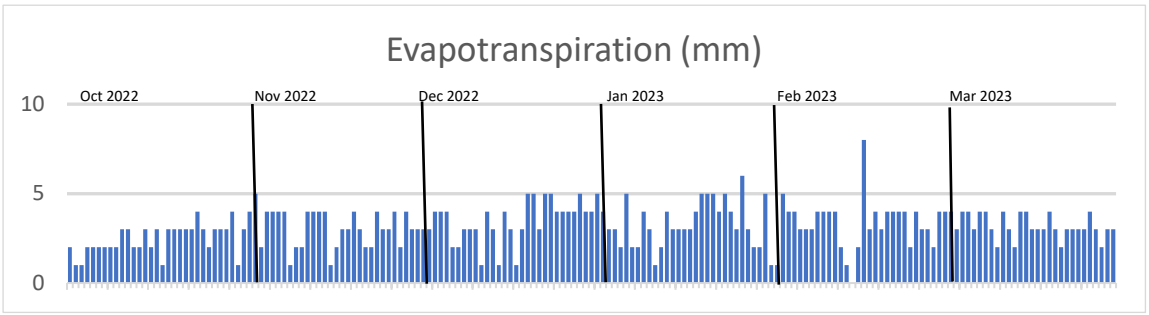


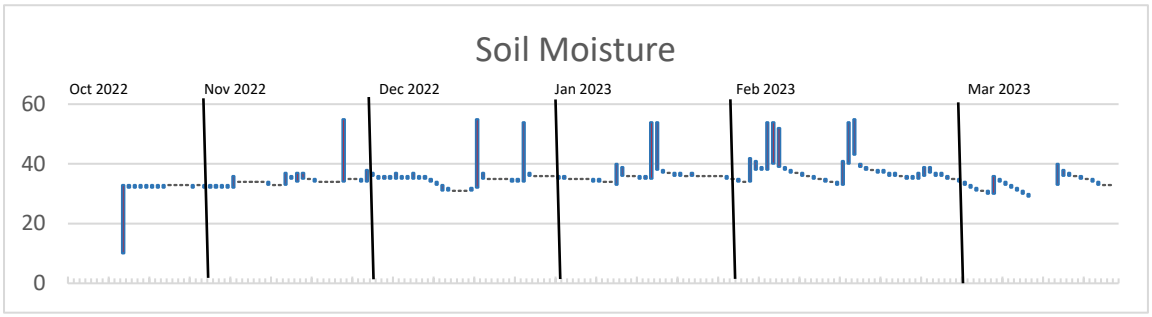
Above graph is the minimum and maximum air temperature recorded each day

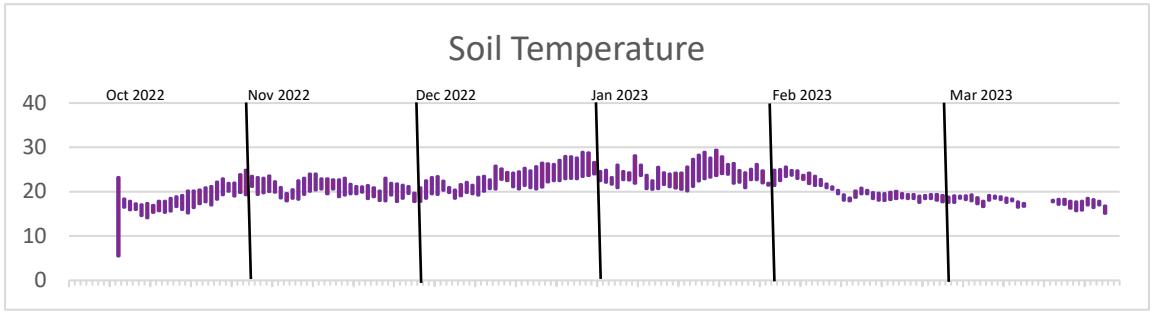


Above graph is rain fall in mm recorded each day with total 296mm for the period *(rain gauge was faulty in October – November)*









4.8 Irrigation management

Regular monitoring using remote monitoring equipment and site visits to determine application of irrigation.

Irrigation was used after planting to get plants established. With all the rain there was no further need for irrigation.

4.9 Crop Learnings

The lead-in to the season was exceptionally wet, making it difficult for contractors to access sites for spraying and cultivation. Whenever conditions allowed progress, another wet front would move in, further delaying preparations. As a result, planting was postponed from the expected date in October to December 19, 2022, as soil temperature needed to reach a minimum of 25 degrees Celsius for successful planting and germination. Delay in planting due to wet weather and inability to get machinery onto the sites.

Some of the key issues faced during the delayed planting included the

- inability to use machinery due to wet conditions
- lack of registered chemicals for pre-runner establishment weed control

- need for manual or mechanical weed control before runner establishment
- plant spacing was also necessary to suppress weeds
- side dressing or fertigation could be applied before the plant starts to run

Once plants were established, irrigation was necessary for plant establishment post-germination, resulting in better canopy cover and stronger plants. Minimal pest management was required, and it was essential to harvest before the leaves desiccated to prevent fruit sunburn.

4.10 Site Learnings:

Despite all the rain events this season, the underground spring that was in the middle of the site in the previous season had disappeared. Once conditions allowed, cultivation and planting took place without compromising the soil structure.

4.11 Harvest

Volunteers from Te Roroa harvested the squash over 2 days. Table below shows yields achieved for the season. Expected yields are in the range of 12t per ha

Squash varieties	Area size m^2	Area Weight kg	Yield ton per ha
Delica – Irrigated	1095	1,314	12.0
Delica – non irrigated	1528	1,956	12.8
T-133 irrigated	1248	1,263	10.12
T-133 non irrigated	1915	2,390	12,48
Total	**5,789**	**6,923**	**11.96**

Photo 15 – some of the harvest to be distributed

4.12 Site costs

Site costs for trial demonstration sites are predominantly higher than for a grower/farmer. All contractors engaged for this project were from Dargaville therefore additional time/mileage must be factored into overall site costs.

4.13 Conclusions

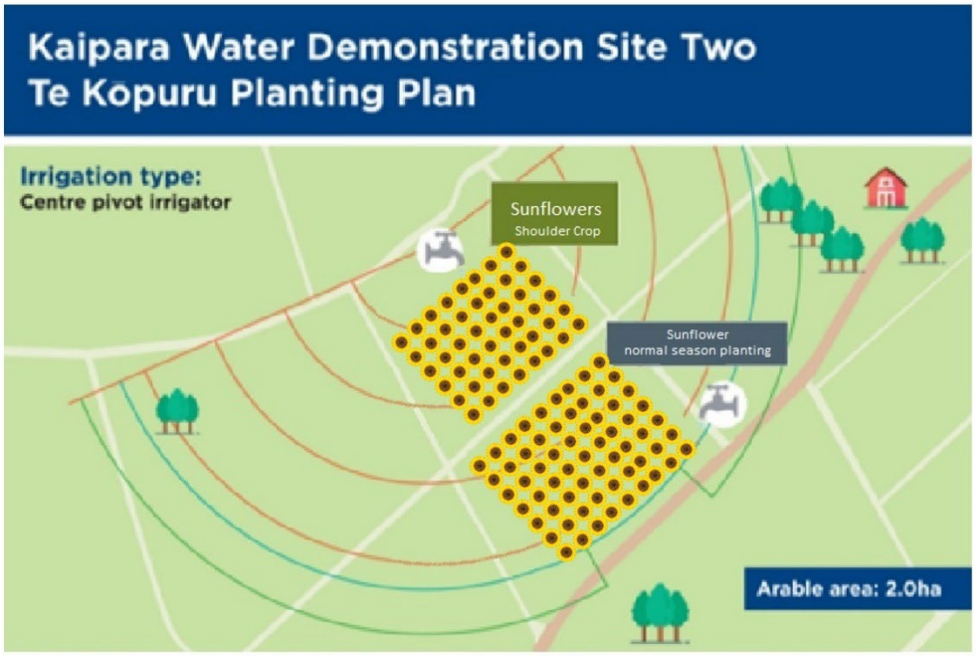
This year has been an extremely wet one which has caused a number of challenges. Half of each variety was irrigated which highlighted the value of applying water post planting as germination in these areas was more advanced by a few days. With the continued wet throughout the growing season the non-irrigated areas performed well, this was reflected with the harvest yields. If the season was a normal season the value of irrigation would have been more evident. In conclusion applying water throughout from planting through to harvest improves plant health and higher yields when natural rain fall is below average.

5 Site 2 – Te Kopuru (Rope property)

Property located at Turkey Flat Road, Te Kopuru

GPS: -36.040156370622654, 173.91661625881736

Site arable area 2.0 ha



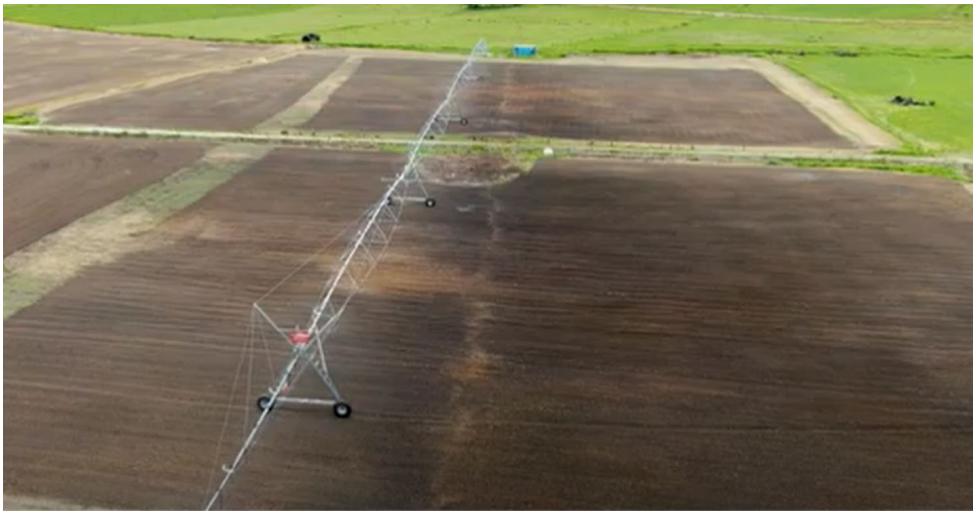


Photo of the site prepared from the 2021-2022 season.

5.1 Season Overview

The entire growing season this year has been extremely wet which delayed multiple times the spraying, cultivation, and planting of the site. These activities were delayed until conditions were suitable to ensure the best chance of crops survival whilst preserving soil structure and minimizing damage to the land. The site preparation was attempted multiple times with initial site spraying out the winter clover in October and then again in December 202 and January 2023. However, the site conditions didn't improve enough to not only plant the main sunflower crop in late October but also the shoulder season crop late December 2022. The site flooded in its entirety during February's cyclone Gabrielle.

Photo 16 taken from Turkey Flat Road, site underwater from Cyclone Gabrielle

5.2 Sunflower Crop

Crop	Plant	Duration in days	Harvest
Sunflower Hi-oleic	October 2022	130-140	6 March 2023
Sunflower Hi-oleic	Late December 2022	130-140	24 April 2023

Sunflower plants have deep roots and extracts water from depths not reached by most other crops; thus, sunflower is perceived to be a drought-tolerant crop. Sunflower has an effective root depth of around four feet but can remove water from below this depth. Research on side-by-side plots has shown that sunflower is capable of extracting more water than corn from an equal root zone volume. With its deep root system, it also can use N and other nutrients that leach below shallow-root crops; thus, sunflower is a good crop to have in a rotation. Seasonal water use by sunflower averages about 19 inches under irrigated conditions. Under dryland conditions, sunflower will use whatever stored soil moisture and rain that it receives during the growing season. When access to water is not limited, small grains as a crop, use 5 to 8 cm less total water than sunflower during the growing season,

whereas soybean water use is slightly greater. Corn uses 2.5 to 10 cm, and sugarbeet use 5 to 15 cm more than sunflower during the growing season.

Learnings: site is susceptible to flooding with multiple rain events occurring causing ponding and flooding. This impacted on the ability to have machinery on site to cultivate and plant as required to protect the soil structure. With the excessive moisture any planting would have reduced germination and a high probability of seed rotting in the ground resulting in total crop failure.

5.3 Irrigation Systems

The pivot irrigation system has a span of 242 meters which is programmed and controlled remotely. Was serviced in December with a self-prime pump installed. With the extreme wet season and no sunflowers planted the irrigator was not used.

5.4 Pest Control

No pests identified this season.

5.5 Weed Control

This season had unusually wet conditions in the lead up however between windows of opportunity, the winter clover crop was sprayed out in October 2022 in preparation of cultivation and planting of sunflowers by late October. The site was divided into two 1 hectare blocks one for normal planting scheduled for late October, the second for shoulder crop scheduled for mid-December. The site was sprayed again Mid December 2022 and late January 2023


Nightshade


Alligator Weed


Kikuyu
Wild Portulaca

5.6 Fertilizer management

Initial soil tests were conducted on site and the results sent to Fertilizer company Agronomist for analysis and a fertilizer application. This was followed as per recommendations.

Base Fertiliser:

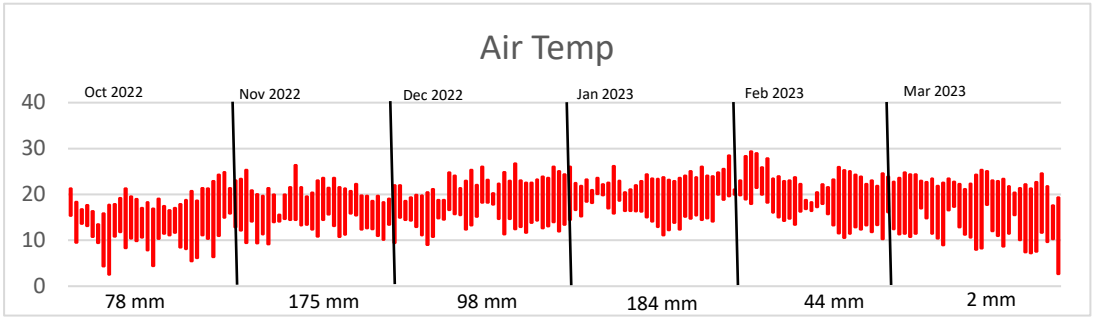
Crop	Product	Application time/Rate
Sunflower	N30 P30 K20 S67 Ca67	10/10/22 475kg/ha.

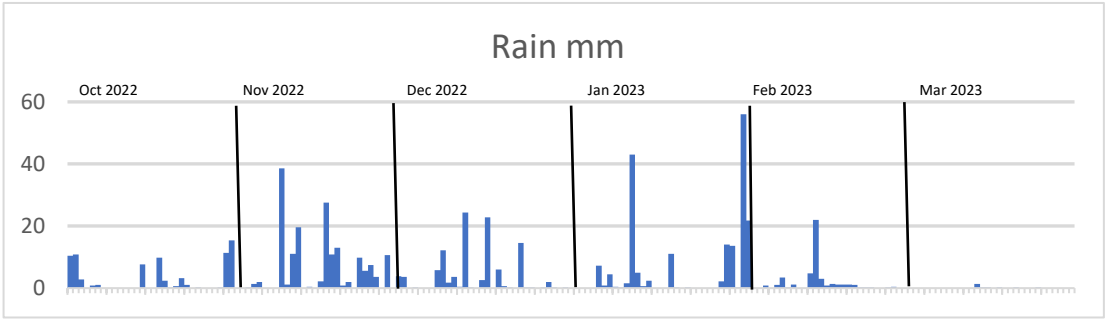
5.7 Irrigation management

The irrigator was serviced, and prime pump fitted in December 2022. As the site was not planted the irrigator was not used.

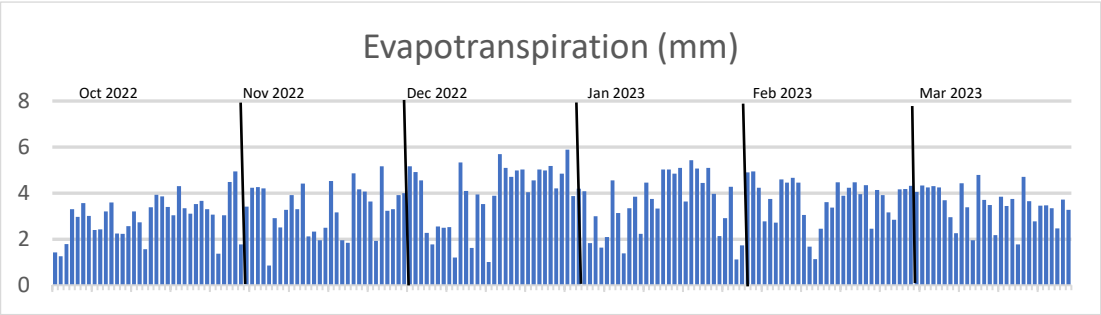
5.8 Monitoring System - Harvest

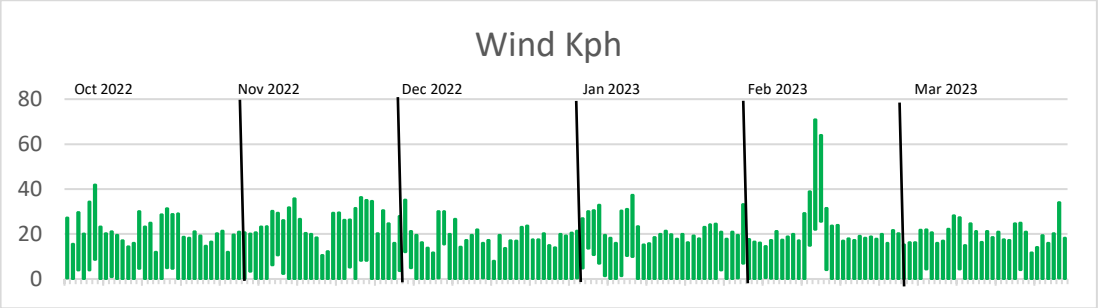
The site has a Harvest monitoring station attached to the top of the container and soil probes placed in the ground to monitor conditions. This measures air temperature, Rain, Wind, ET (evapotranspiration), soil moisture and soil temperature which are graphed below for the season.

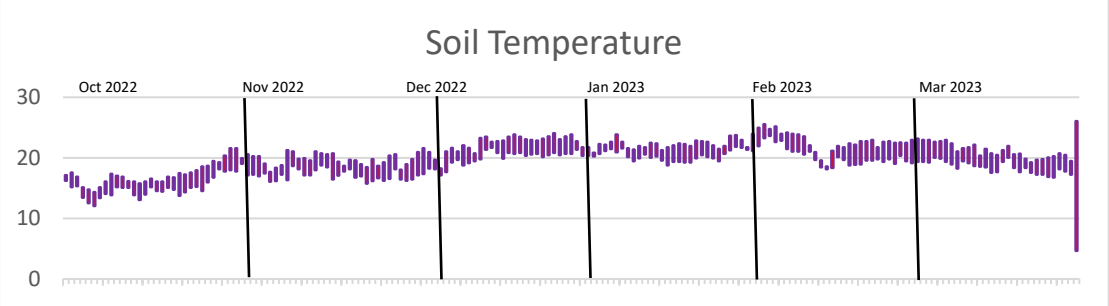


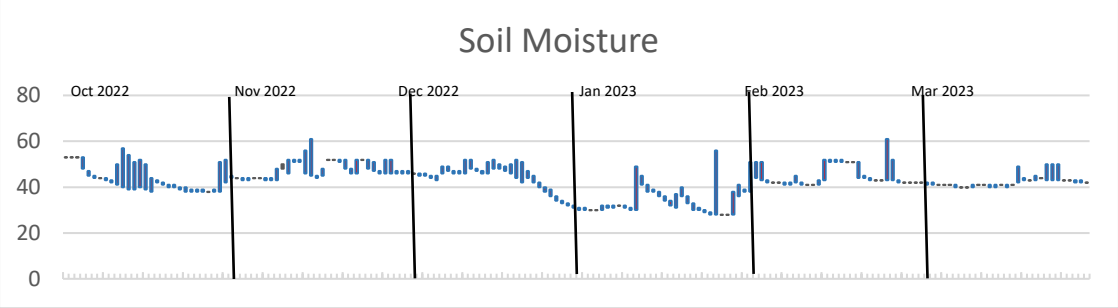


Total rainfall for the period 583mm









5.9 Water take management

Water take was monitored to ensure compliance associated to resource consent for the property. Water take flows were above the minimum take level of 19 liters per second.

5.10 Crop Learnings

There are no crop learning as the crop was not planted due to continued rain events and ground conditions not allowing preparation and planting to occur.

5.11 Site Learnings

The ground conditions did not allow for both the normal season and shoulder crop to be planted due to extreme wet weather events across the entire season. The site held water ponds on multiple occasions and completely underwater with cyclone Gabriella on 14 February 2023.

5.12 Harvest

Site was not planted this season despite multiple attempts there for there is no harvest