

# VICTORIA DROUGHT RESILIENCE ADOPTION AND INNOVATION HUB (VIC HUB)

## KEY POINTS

- **The Vic Hub is giving farmers and regional communities tools to address climate variability, enhance drought preparedness and adopt relevant, innovative practices.**
- **Riverine Plains have appointed an Adoption Officer for the Vic Hub to represent our region through contributing to project development and sharing resources that address identified priorities.**
- **The work to date has demonstrated that while there is a large amount known about drought and climatic cycles, there are still many knowledge gaps that need filling to help our region be prepared for climate variability through continued, local support and adoption.**

## BACKGROUND

The Vic Hub is led by the University of Melbourne's Dookie Campus, in association with five regional nodes, led by highly respected farming and industry groups Birchip Cropping Group (NW Node); Riverine Plains (NE Node); Food & Fibre Gippsland (Gippsland Node); Southern Farming Systems (SW Node), and Mallee Regional Innovation Centre (NW Irrigated Horticulture Node). It is further supported by Deakin University, La Trobe University, Federation University Australia and Agriculture Victoria. The Vic Hub represents a comprehensive approach to enhancing economic, environmental and social resilience to drought in order to create innovative and profitable sectors, sustainable and functioning landscapes, and resourceful and adaptable communities.

Lynn Macaulay has been appointed as an Adoption Officer with the Vic Hub's northeast regional node. Lynn works with the team at Riverine Plains, our members, and individuals across the region to provide information to the Hub on key priorities around drought preparedness and innovation.

## PROJECTS

The development of an investment prospectus for the use of stock containment practices commenced in November 2021 with the employment of a livestock officer for Riverine Plains. We ran multiple farmer focus groups

across the region to gain insight on current stock containment systems and investigate where greater investment could lead to wider spread adoption of the practise. The business case has been finalised and we are in consultation with other farming systems groups and large-scale organisations on further funding work in this space.

Other projects we are working on in collaboration with the Vic Hub partners are the *Drought resilience practices* in mixed farming systems project. Riverine Plains has increased its project portfolio as a result of Vic Hub support; such projects include *Agriculture Innovation Program – Digital agriculture, building capacity for community-led drought resilience action, Silicon fertiliser for drought resilience in broadacre cropping, and the Accelerating the adoption of agri-tech solutions by female farmers* project. New projects recently commenced, also facilitated through involvement with the Hub, include a feasibility study on renewable energy on farms and assessing the suitability of small-farm dams.

## SUMMARY

Key priorities for action identified through initial and ongoing consultation through the Vic Hub have enabled the rapid development of project, extension and capacity building opportunities. These opportunities will be essential in assisting the communities in northeast Victoria prepare for climate variability and to be innovative. Riverine Plains, in the capacity as the northeast Node, is committed to providing resources through our well-established communication channels, including social media, emails, and blog posts, and at events held throughout the year.

## ACKNOWLEDGEMENTS

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# SILICON FERTILISER FOR DROUGHT RESILIENCE IN BROADACRE CROPPING

## KEY POINTS

- **When applied in drought-stress trials, silicon (Si) has demonstrated increased photosynthetic activity of the plant and improved water relations, leading to improved crop yield.**
- **Silicon fertiliser application has not shown any significant differences in biomass and grain yield of the evaluated crops this season. The season's climate must be considered when interpreting this result, as it was not a typical season where crops can face periods of moisture or heat stress.**
- **Visual effects of stay-green phenotype (prolonged green foliage) were observed in wheat plots later in the season, indicating Si's beneficial effects.**

## BACKGROUND

In Australia, drought and heat events have challenged the resilience and profitability of farming businesses. Climate change requires a more resilient farming approach to sustain farm productivity. Diversified farming options can make existing farms more resilient and profitable in changing climate scenarios. On-farm diversification can be a promising strategy for farming communities to cope with and recover from stresses like drought.

This project is supported by Riverine Plains, through funding from the Australian Government's Future Drought Fund. Northern Victoria is one of four regions in

Australia with the highest level of drought risk (ABARES, 2020). Because of the propensity to drought, broadacre farming systems across southeastern Australia require sustainable approach to remain productive and profitable when exposed to increasing risks from more frequent droughts.

The parent project, 'Whole-system redesign of broadacre farming of southeast Australia', aims to help the agricultural industry to cope with, and recover from drought. One of the main drought mitigation strategies being trialled is the use of Si fertiliser in broadacre systems. The project also demonstrates overall farm diversity enhancement with the inclusion of native vegetation cover on non-farming areas of the farm.

## AIM

To provide evidence-based, innovative research for diversified farms in south-eastern Australia. The projects aims are:

1. to demonstrate the potential role of legumes incorporation in the wheat/canola monocropping system
2. further consider the option of dual-purpose wheat (grain and graze option) cultivars in the Riverine Plains region
3. to showcase cost effective drought mitigation strategy to the farming community, i.e., foliar application of Si
4. to consider the health of cropping ecosystem, integration of native vegetation on the farmland to diversify farms income.

Table 1. Site details

<b>Sowing date</b>	15 June 2022
<b>Varieties</b>	Spring wheat: Scepter Dual-purpose wheat: Annapurna Faba bean: Samira Canola: Roundup Ready
<b>Starter fertiliser</b>	80kg/ha MAP
<b>In season fertiliser</b>	150kg/ha Urea (not on faba beans)
<b>Soil mineral N</b>	38.5kg/ha
<b>Average annual rainfall</b>	542mm
<b>Actual annual rainfall</b>	679MM

## METHOD

Eight plots were sown to each crop type, in a paddock within the Riverine Plains region. Crop types included faba beans, spring wheat, dual-purpose winter wheat, and canola. The treatments were control (no Si) and foliar Si application, with four replications per treatment. Before sowing, 12 soil cores were taken across site, segmented into 0-10cm and 10-20cm (pre-sowing soil chemical analysis is presented in Table 2). A demonstration site for faba beans was also included as a part of this project. This site was managed within a farmer's paddock and Si fertiliser spray was applied to half of the selected area. The commercially available Si fertiliser was applied at the rate of 300ml/ha, with a water rate of 400L/ha, five times throughout the season. The first application was in mid-August, GS30 in wheat, with the consecutive sprays being applied 10-14 days after the previous.

A native corridor assessment by expert Meredith Mitchell and FDF project staff identified plants and marked them for continuous monitoring.

Table 2. Pre-sowing soil chemical properties

SOIL CHEMICAL PROPERTIES	PRE-SOWING 0-10CM	PRE-SOWING 10-20CM
pH (CaCl <sub>2</sub> )	4.8	4.9
EC (dS/m)	0.06	0.07
Nitrate N (mg/kg)	12	13
Ammonium N (mg/kg)	6.9	3.1
Colwell P (mg/kg)	12	27
PBI	91	90
Organic carbon %	0.3	1.3

## RESULTS AND DISCUSSION

Site details and soil data are shown in Tables 1 and 2. Post-harvest soil test data are at analysis stage, and not included in this report. Due to excessive rainfall, all canola replicates were not taken through to harvest at the Uncle Tobys site. Faba bean replicated plots were maintained near our demonstration site, in Bundalong South, due to poor establishment at the Uncle Tobys site. The faba bean replicated trial did not receive all anticipated Si sprays due to unexpected rains and a road closure due to flooding, therefore the results are not included in this report.

Three different types of native grasses were identified in the Riverine Plains native corridor. To understand the impact of these native grasses on the soil microbial community composition, diversity and their role in shaping the soil health for sustainable crop production, soil samples will be taken throughout the length of the project.

Grazing wheat plots had half the plot area mown (to represent grazing) at GS25. The biomass cuts were taken for all plots at GS33 (wheat) and again at GS65 (wheat). Approximately 2.7m<sup>2</sup> of the grazed area of the plot was sprayed with Si fertiliser and 1L/ha of micronutrient formulation in mid-October to enhance crop re-growth after a grazing period. Final biomass cuts and harvest index calculations were taken on this portion of the plot to compare with the unsprayed control grazed area.

Harvest index was calculated at crop maturity. Plots were harvested for grain yield and sub-samples were taken to test protein and nutrient content. The dual-purpose wheat plots were harvested separately, the grazed and non-grazed areas.

Tables 3 to 5 show biomass, harvest index, plot yield and grain traits, averaged across all replicates. Across all crop types at this site, no significant difference was observed between the treatment of Si and control. Visual differences were observed with Si-treated plots showing slightly higher growth and extended green foliage compared to their non-treated counterparts.

Table 3. Biomass results

CROP TYPE	1ST BIOMASS T/HA - CONTROL (EARLY-MID OCT)	1ST BIOMASS T/HA - SI TREATED	2ND BIOMASS WHEN?? T/HA - CONTROL	2ND BIOMASS T/HA - SI TREATED
	(Early-mid October)		(Mid-December)	
Canola	3.93	4.46	N/A	N/A
Wheat	6.71	8.12	8.71	10.55
Grazed Dual-purpose Wheat	4.22	4.12	3.17	4.31
Grazed Dual-purpose Wheat + Micronutrient Treatment	N/A	N/A	5.24	5.03
Non- Grazed Dual-purpose Wheat	8.35	4.12	7.81	8.9

Table 4. Harvest traits

CROP TYPE	HARVEST INDEX - CONTROL	HARVEST INDEX - SI TREATED	YIELD T/HA - CONTROL	YIELD T/HA - SI TREATED
Wheat	44.34	41.40	2.65	3.02
Grazed Dual-purpose Wheat	47.19	48.86	3.4	3.44
Grazed Dual-purpose Wheat + Micronutrient Treatment	49.75	48.86	2.6	2.48
Non- Grazed Dual-purpose Wheat	35.46	40.24	1.88	2.07

Table 5. Grain traits

CROP TYPE	GRAIN PROTEIN % - CONTROL	GRAIN PROTEIN % - SI TREATED	MOISTURE % - CONTROL	MOISTURE % - SI TREATED
Wheat	9.9	9.6	6.3	5.45
Non- Grazed Dual-purpose Wheat	8.72	8.28	8.1	6.03

The native corridor area will be analysed throughout the duration of the project to understand the effect native vegetation on the soil biodiversity and nearby cropping systems. These results will be included in future Trial Book articles.

Silicon is a micronutrient that has been used in previous drought-stress trials under controlled and field conditions at The University of Melbourne. Silicon induced tolerance to abiotic stresses, such as drought, promotes enzymatic

activities, and therefore improves photosynthetic efficiency. Results from previously published research trials showed that Si applications have improved water relations through higher water uptake by roots, reduced water loss from leaves, and improved antioxidant defense mechanisms. Silicon application may have potential to improve grain quality by increasing antioxidant compounds in the grain. Silicon application can potentially increase the soil microbial biodiversity and nitrogen fixing capacity in legumes.

## CONCLUSION

Previous research trials have confirmed that the effects of Si on plants are primarily seen in times of stress (such as drought and heat). It can be inferred that no significant differences were seen between the treatment of Si and control (no Si) across all crop types, due to the extremely wet seasonal conditions, including flooding, across the sites. Extended stay-green phenotypes were observed in spring wheat, providing a reasonable indication of the positive effect of foliar Si application regardless of waterlogged conditions.

## ACKNOWLEDGEMENTS

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# IMPROVED DROUGHT RESILIENCE THROUGH OPTIMAL MANAGEMENT OF SOIL AND WATER

## KEY POINTS

- **Diverse legume rotations may help build soil organic carbon.**
- **Early sowing of slower-maturing crops may lead to higher crop water use efficiency; this demonstration will commence in the region in 2023.**
- **Measuring residual mineral nitrogen will aid in preventing excess application, increase profitability, and decrease environmental losses.**
- **It is recommended to split deep nitrogen samples (for example 0-30cm and 30-60cm) to ascertain location of nitrogen in the soil profile.**

## BACKGROUND

The project *Improved drought resilience through optimal management of soil and water* covers central and southern New South Wales regions with 12 demonstration sites.

The project is supported by Riverine Plains, through funding from the Australian Government's Future Drought Fund and the Grains Research and Development Corporation (GRDC).

The purpose of the project is to improve the management of natural capital through increased water use efficiency, soil organic carbon, and nitrogen utilisation, which, in-turn, is crucial to environmental and economic resilience in drought. These sites will focus on three strategies that have been proven previously, through the work of John Kirkegaard, in small scale field trials in New South Wales.

There were two sites in the Riverine Plains in 2022, with an additional site being added in 2023. Throughout the project, case studies and marketing collateral will be produced to ensure information is dispersed to encourage wider adoption across Australia. These will be promoted through the Vic Hub and the sNSW Hub and their farming systems groups.

## FOCUS Paddock 1: DIVERSE ROTATIONS

### AIM

To demonstrate how diverse legume rotations can fit into the modern farming system and potentially help build soil organic carbon.

### METHOD

A host farmer from Howlong had two paddocks side-by-side to compare a non-legume and a legume rotation. In 2022, a paddock was sown half to wheat and half to faba beans. In 2023, the entire paddock will be sown to canola. Previously the paddock was in a wheat/canola rotation. The paddock can be irrigated by an overhead irrigator, but was not irrigated in 2022, due to the very high rainfall.

The following measurements were taking to identify the value of a diverse rotation:

- soil tests 0-30cm and 30-60cm, gravimetric soil water analysis, nitrogen content and organic carbon pre-sowing and post-harvest, GPS located on the same spot
- plant counts
- biomass counts at mid-pod fill
- nitrogen<sup>15</sup> (N15) analysis on faba beans and reference plants



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