Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry

2020 round - 12-month and final report

As part of your 2020 Science Award grant you are required to provide milestone reporting at the 6-month and 12-month marks, which will be provided to ABARES and your Award sponsor. This is the 12-month and final report template. Please complete by providing detailed and clear information on your project and project outcomes. It should capture the full results of your project and be explained in depth. Challenges or unexpected obstacles, and how these were managed, can also be reported. Photos, charts, graphs, and other documentation can be included. Refer to your funding agreement and milestones when completing this report.

As noted in your Funding Agreement, this final report should also include

1. a financial statement for receipt, holding, expenditure and commitment of the Funding during the duration, including a full reconciliation against the Budget and a statement of the balance of the Bank Account (relevant to the Grant only);
2. a signed statutory declaration as to whether the Project was carried out in accordance with the objectives, milestones, and key performance indicators. The signatory can be the chairperson, managing director, chief executive, or equivalent officer of the Grantee.

We understand that these two items may take longer to coordinate and are agreeable to receiving the 12-month report in the first instance, with the financial statement and signed statutory declaration to follow within one month.

The due date of your 12-month progress report will be advised by the Community Grants Hub

Name: Dinesh Kafle
Award Sponsor: Cotton Research and Development Corporation (CRDC)

1. **Description of your project** provide a short paragraph describing your project, including any variations.

Annual disease surveys conducted by the Queensland Department of Agriculture and Fisheries and NSW Department of Primary Industries show that Fusarium wilt, caused by the fungal pathogen *Fusarium oxysporum* f. sp. *vasinfectum* (*Fov*), is a significant disease of cotton in Australia (Cotton Research and Development Corporation [CRDC], 2022). Although not as prevalent as fusarium wilt, the plant-parasitic reniform nematode (*Rotylenchulus reniformis*) is known to hinder plant growth resulting in yield loss in Central Queensland (CRDC, 2022). The cotton industry relies on integrated disease management (IDM) that includes the use of resistant varieties, seed treatment and crop rotation. At present, there are not any nematicides or resistant varieties effective against reniform nematodes. Thus, developing and adding new IDM tools and techniques to the existing IDM toolbox is highly important. This project aims to fill this gap by testing the role of silicon in cotton defence against *Fov* and reniform nematode.

Earlier studies have shown that plants treated with silicon contain higher silica deposition within root tissue which hinders pathogen entry (Van Bockhaven et al., 2012). Furthermore, silicon is also known to activate and regulate the plant defence pathways (Coskun et al., 2019). With the help of four different glasshouse trials, this project has tested if silicon primes the cotton plants for a quicker and enhanced response against *Fov* and reniform nematode infection. Such an effect was investigated under the transplanted and direct sowing system. Priming is a process through which an organism can remember past stimuli or stress experiences and therefore prime its responses for quicker or stronger reaction to future stress (Conrath et al., 2006, Hilker & Schmülling, 2019). I hypothesised that priming the cotton plant with silicon during the seedling stage before they encounter pathogens may have added benefit. Such primed seedlings may have a better response against pathogens when transplanted into the soil with pathogens and nematodes. On the other hand, plants in a direct sowing system may not have such a benefit as the seedling comes into the contact with pathogens as it emerges without the benefit of prior exposure to silicon amendment.

All the trials were conducted in a climate-controlled walk-in cabinet which has a limited space to conduct such trials simultaneously. Thus, the trials needed to be carefully scheduled but unfortunately the travel restrictions, facility closures, and lockdowns due to Covid-19 seriously delayed the timely implementation of the trials. Hence, the project period was extended twice, making it one and half years longer than originally planned. Despite the delays, the objectives and aims of the project were not changed during the project period and all the milestones have been achieved successfully.

2. Project milestones completed Describe the milestones and outcomes completed in this stage. If any milestones were not undertaken or varied from your funding agreement, please provide an explanation. Refer to your funding agreement for the agreed list of milestones.

All the milestones have been completed with some variation in original timeframe as discussed above. The major outcomes of these milestones/activities are as follows:

1. Literature review and experimental design: The literature review was done extensively to understand the previous research work on the role of silicon in plant protection. A plethora of research work has been carried out to assess the role of silicon on plant defence and resistance against soil-borne pathogens (Ma & Yamaji, 2006; Wang et al., 2017; Islam et al, 2020; Ahammed & Yang, 2021). Previous studies conducted in collaboration with the Queensland Department of Agriculture and Fisheries have suggested the role of silicon in the priming of cotton plants for a quicker and enhanced response against *Fov* (Smith et al., 2005; Whan et al., 2016). Few such studies have explored silicon's role against plant parasitic nematodes, mainly on root-knot nematodes (Zhan et al., 2018; Santos et al., 2021). One such study found the cotton seed treatment using potassium silicate reduced the reniform population (Gad, 2019). The literature review assisted me to shape the scope of my research question and helped me to design my experiments soundly. The review also assisted me to avoid the duplication of previously conducted research.
2. Preparation for the experiment: Once the glasshouse trials were designed, the required greenhouse and laboratory supplies were purchased. A reniform population was maintained for the inoculum. Similarly, the *Fov* inoculum was prepared in the laboratory using isolates collected during the disease survey.
3. Conducting pot experiment: All the trials were conducted in the climate-controlled walk-in cabinets. Cotton plants can be grown in these all year round regardless of the external weather or season.
4. Harvest and sample processing: In the nematode trials, the plants were harvested at least 25 days after inoculation. This period is sufficient for the reniform nematode to complete one lifecycle (Linford and Oliveira, 1940). The nematode population in the soil was assessed following the harvest to analyse their reproductive success. For the *Fov* trials, plants were harvested following the visual foliar symptoms of fusarium wilt disease. Plant shoot tissues were processed to assess the changes in plant growth, and incidence and severity of the disease.
5. Data collection, analysis, and reporting: Plant height, aboveground biomass, disease incidence and severity, were recorded upon the harvest. The effect of different

treatments on these plant parameters was statistically compared using the R programming language (R Development Core Team, 2021). The research findings have been written as a final report.

6. Extension: The research findings have been presented to different forums of researchers and agronomists. Most recently, the reniform result was presented at the online symposium of the Australian Association of Cotton Scientists in August 2022 and in-person at the Australian Soil-borne Disease Symposium at Cairns in September 2022.

3. Results What results do you have from your project? Have the original aims and objectives of your project been achieved? Were there any factors that caused difficulties or setbacks in achieving your goals? Be detailed in documenting the project outcomes.

Four different pot trials were conducted in a climate-controlled cabinet to assess the effect of silicon on the plant's response against reniform nematode and fusarium wilt disease. The cabinet temperature was maintained at 28/22°C (+/-3°C) day/night with a photoperiod of 16/8 hours day/night (maximum Photosynthetic Photon Flux Density of 800 micromoles m–2 s–1). The relative humidity was maintained at about 65%. Cotton variety Sicot B3F 714 was used for all four trials. The Sicot B3F 714 is one of the popular cotton varieties among Australian cotton growers in the irrigated farming system. Previous glasshouse trials with reniform nematode showed that the Sicot B3F 714 is sensitive to reniform nematode which may cause a significant negative effect on its growth and yield (Unpublished data, Kafle et al., 2019). Cotton seeds were sourced from Cotton Seed Distributors (CSD) Australia. For these trials, the soil was collected from a reniform nematode-free field in Theodore (Central Queensland). Additionally, there was no history of occurrence of fusarium wilt in this field. The field soil, a clay-rich vertisol, was homogenised to a fine tilth and mixed with 20% sand to make it easier to work with using a custom-designed soil mixer developed by CSIRO. One-litre plastic pots were filled with 850 ml of soil. All the plants were completely randomised once every week. Plants were watered at intervals of two days. Water was added gently to the soil directly without disturbing the soil. In each watering schedule, water was added in two small volumes to just saturate the soil.

Silicon: A commercial silicon product named "Plant Guard" (previously ZumSil™) was used for all the trials. Plant Guard consists of a 24% (+/-2%) solution of Monosilicic Acid (H_4SiO_4) and has a pH of 12.5. Monosilicic acid is the most readily available form of silicon to plant roots. Switch Innovation Pty Ltd. provided the Plant Guard for these trials. This product is advertised as an organic leaf and root protectant. The recommended dose for cotton is 1L/ha applied twice a season which is liquid-injected into the soil at planting for strong germination, and foliar application at flowering to help the crop set. Based on the recommended dose and dilution of 1:100, each plant was treated with 1.01 ml of diluted

product. This concentration is calculated considering 10 plants per square metre in field conditions.

Statistical analysis: All the statistical analyses were performed using the statistical platform "R", version 4.1.0 (R Development Core Team, 2021). Student's t-test was used to compare the effect of silicon treatment on nematode population and fusarium wilt severity. Two-way factorial ANOVAs were performed to test the significance of the treatments. The data on the nematode population in soil were log-transformed to meet the assumptions of the Student's t-test. The shoot biomass from Trial A and Trial C and the plant height of Trial C were analysed with GLM, assuming gamma distribution of errors as the data were not normally distributed.

Trail A: Priming of cotton plant response against reniform nematode in the transplantation setting

Background and objectives:

This trial was conducted to test the effect of silicon priming of cotton seedlings against subsequent nematodes. These seedlings received the silicon treatment at the sowing stage and were grown for two weeks in pathogen and nematode-free soil before being transplanted into the field soil infested with reniform nematodes. Thus, there was a lag phase or priming phase of two weeks before seedlings were exposed to the reniform nematodes. I hypothesised that these silicon-primed seedlings are better prepared at responding against reniform nematodes compared to non-primed seedlings.

Methods and materials:

Two seedling trays were filled with autoclaved M-mix potting media. Seeds were sown individually in each cell. In the first tray, each cell received 1.01 ml of silicon which is equivalent to 1 litre/ha. Silicon was added to the potting media at sowing and continued for two weeks after seed germination to prime the plant. To ensure the silicon will not be leached, the bottom passage hole was sealed and tested for non-leakage. The second tray received only water. Seedlings were transplanted into experimental pots after two weeks. The total volume of soil in the pot was 850 ml including the potting mix attached to the seedling from the seedling tray.

To inoculate the pots with reniform nematodes, the pre-plant threshold level of 500 nematodes per 200 ml was used. This threshold level is based on previous research conducted in the USA (Weaver, 2015). Thus, each pot containing 850 ml of soil received approximately 2125 individual nematodes. The reniform nematodes were inoculated from the top of the soil.

Four small holes (≤1cm) were made at an equal distance from each other and water suspension containing approximately 2125 nematodes was added to the holes using a pipette.

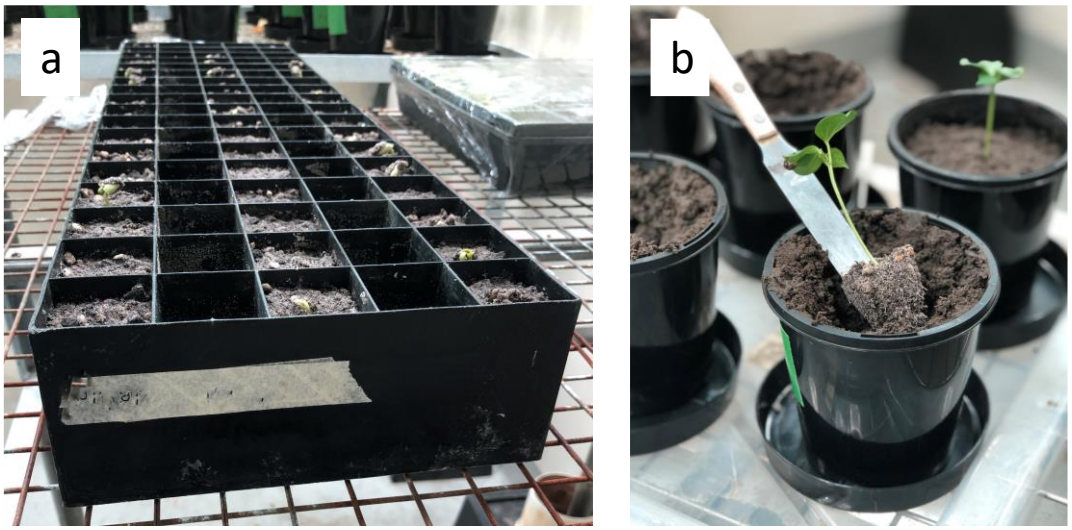

Fig. 1. Cotton seedling germinating on seedling tray (a), and transplantation of two weeks old seeding to 1 litre pot (b).

There were four treatments as follows:

Treatment 1: Control (No silicon or nematode): Plants in this treatment were transplanted from the second tray that received only water.

Treatment 2: Silicon only: Silicon-primed seedlings from the first tray were transplanted into the pot with clean soil.

Treatment 3: Nematodes only: Seedlings from the second tray were transplanted into the soil that had been inoculated with reniform nematodes on the day of transplantation. The soil was inoculated with 2125 nematodes just before transplantation.

Treatment 4: Silicon followed by nematodes: Silicon-primed seedlings from the first tray were transplanted into the soil inoculated with reniform nematodes on the day of transplantation. The soil was inoculated with 2125 nematodes just before transplantation.

Plants were harvested at 18 weeks; 126 days after the sowing (DAS). This timeframe would have been sufficient for the reniform nematode to infect, establish a feeding site, and reproduce at least four times.

The plant height was measured just before harvest. The dry shoot biomass was measured after drying the above-ground plant materials for three days at 65℃ using a dehydrating oven (Thermoline, Australia). The soil was collected to extract the reniform nematodes to estimate their population in the soil. The nematode population in each pot was estimated by extracting nematodes from the soil subsample taken from each pot using the whitehead tray method (Whitehead & Hemming, 1965).

Nematode extraction from soil sample using the Whitehead tray method was conducted as described below:

The volume of soil from each of the three sections was measured and placed into a whitehead tray (metal sieve with a tissue paper layer placed inside a tray) and water was added to moisten the soil. Trays were placed inside a cabinet for three days of incubation. After the incubation period, the metal sieve containing the soil was removed and the remaining solution was poured through two fine sieves, one to remove soil debris (150-micron sieve) and one to collect the nematodes (38-micron sieve). The nematodes were rinsed from the sieve surface into a vial which was then analysed under the microscope for identification and quantification of plant-parasitic nematodes. All plant-parasitic nematodes were reported as numbers per 200 ml soil.

Results:

1. Reniform population in soil: Silicon priming significantly reduced the nematode population in transplanted cotton (Fig. 2) (t = -3.2892, df = 14, p-value = 0.005).

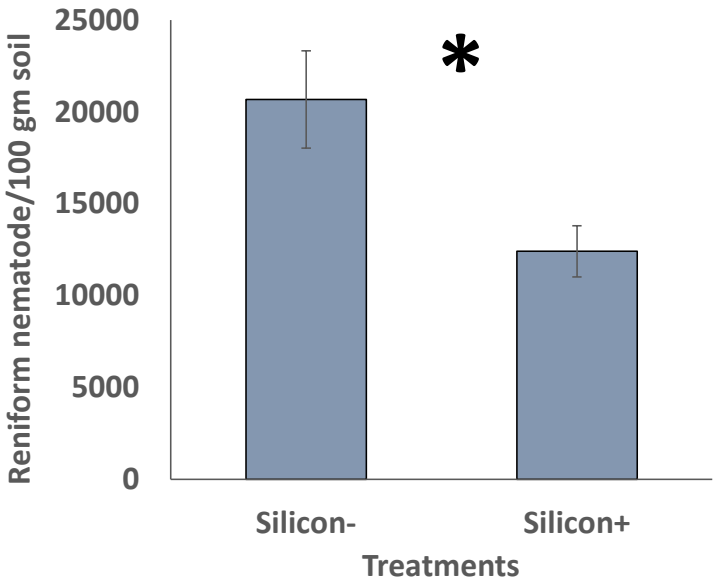

Fig. 2. The total number of reniform nematodes per 100 g of dry soil of non-primed (Silicon-) and primed (Silicon+) plants (M ± SE). An asterisk (*) indicates a significant difference between the mean number of nematodes at $p < 0.05$.

2. Plant height and shoot biomass

Neither silicon nor nematode treatment had any effect on plant height (Fig.3.a) while reniform nematode significantly reduced shoot biomass (Fig.3.b). There was no interaction between the silicon treatment and reniform nematodes on any tested plant parameters.

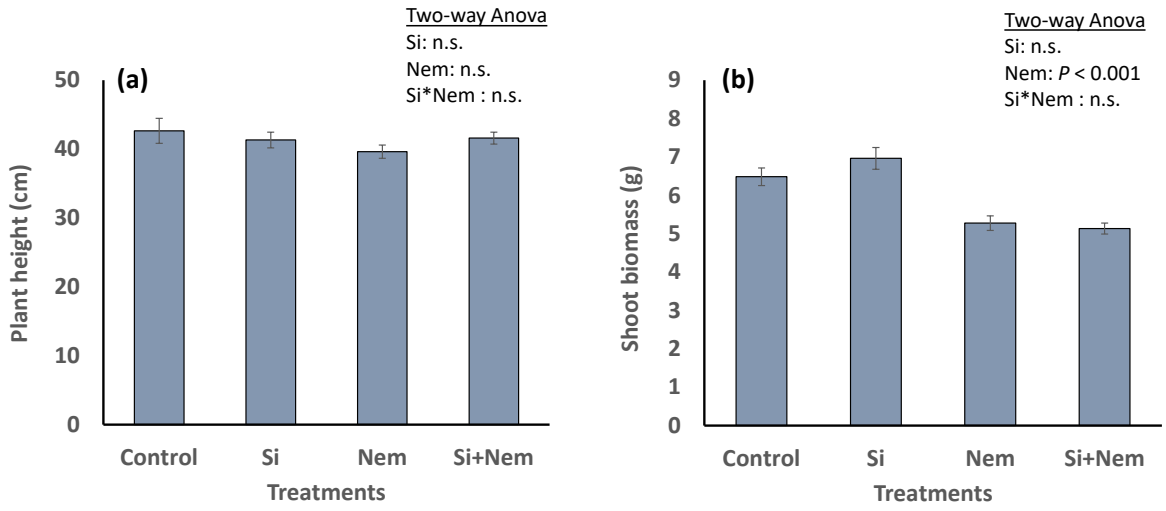

Fig. 3. Average plant height (cm) (a), shoot biomass (g dry mass) (b) of the plants (Mean ± SE), n.s. stands for not significant. Treatments: Control, Si: Silicon only, Nem: Nematode only, and Si + Nem: Silicon-primed seedlings were transplanted to the pot inoculated with nematode two weeks after sowing.

Trial B: Priming of cotton plant response against reniform nematode in the directly sown setting

Background and objectives:

This trial aimed to assess the effect of silicon treatment on cotton against reniform nematodes when it was applied at the time of seed sowing in the direct sowing setting. In this trial, the plants were exposed to the reniform nematodes from the first day thus there was no lag phase between the silicon treatment and exposure to the reniform nematode. I hypothesised that due to the lack of a lag phase or priming period, the priming response of the plants against the reniform nematodes will not be as evident as in the transplantation setting (Trial A).

Methods and materials:

For this trial, seeds were grown directly into the soil in the experimental pots. Four seeds were sown per pot to ensure germination and thinned out to one plant immediately after germination. The silicon treatment and reniform nematode inoculum were added on the day of seed sowing.

There were four treatments as follows:

Treatment 1: Control (No silicon or nematode): Plants in this treatment received only water.

Treatment 2: Silicon only: Plants received silicon on the day of sowing

Treatment 3: Nematode only: Seeds were sown into soil that had been inoculated with 2125 individual reniform nematodes on the same day.

Treatment 4: Silicon plus Nematode: Seeds were sown into soil that received silicon and was inoculated with 2125 individual reniform nematodes on the same day.

Plants were harvested at 18 weeks or 126 days after sowing (DAS). The plant height, dry shoot biomass and reniform population in soil were measured using the method described in Trial A.

Results:

1. Reniform population in soil: Silicon treatment had no significant effect on soil nematode population in a directly sown setting.

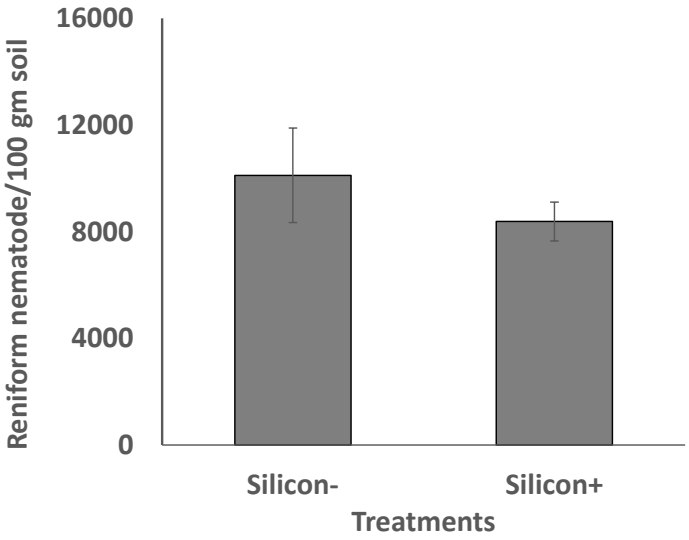

Fig. 4. The total number of reniform nematodes per 100 g of dry soil of non-primed (Silicon-) and primed (Silicon+) plants (M ± SE).

2. Plant height and shoot biomass

None of the treatments had any effect on plant height (Fig. 5. a) while reniform nematode significantly reduced the shoot biomass (Fig. 5. b). There was no interaction between the silicon treatment and reniform nematodes on any tested plant parameters.

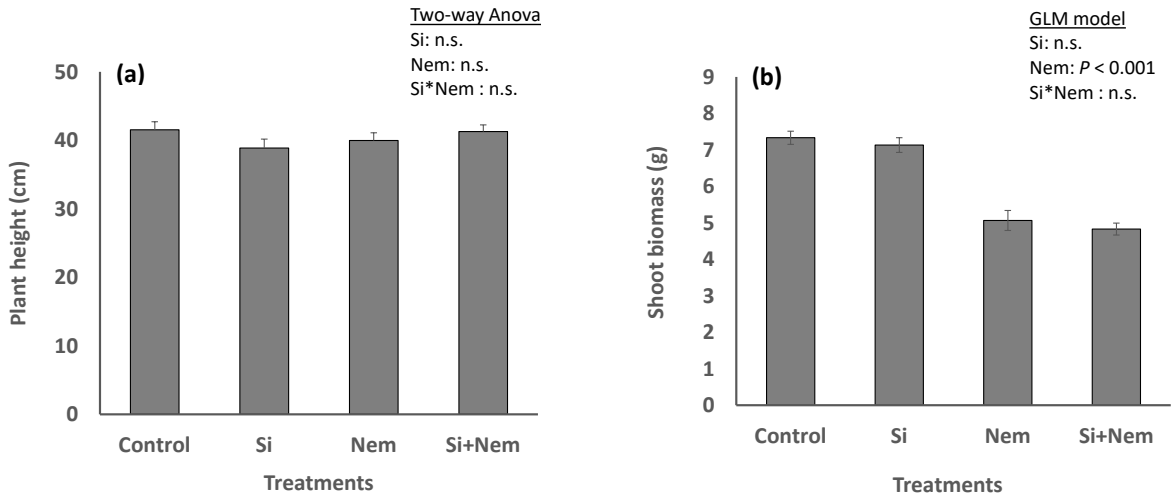

Fig. 5. Average plant height (cm) (a), shoot biomass (g dry mass) (b) of the plants (Mean ± SE), n.s. stands for not significant. Treatments: Control, Si: Silicon only, Nem: Nematode only, and Si + Nem: Silicon and nematode added on the soil on the day of sowing.

Trial C: Priming of cotton plant response against Fusarium wilt in the transplantation setting

Background and objectives:

This trial was conducted to test the effect of silicon priming on cotton seedlings before it is transplanted into the field soil. Similar to trial A, I hypothesised that these primed seedlings are better at responding against *Fov* upon transplantation as they have two weeks of lag or priming phase before being exposed to *Fov*.

Methods and materials:

All the seedling preparation and silicon application were conducted as described in trial A. In this trial, the soil for treatments 3 and 4 was inoculated with *Fov* on the day of transplantation.

Treatment 1: Control (No silicon or *Fov*): Transplant one clean seedling in each pot from tray 2.

Treatment 2: Silicon only: Transplant one silicon-primed seedling in each pot from tray 1.

Treatment 3: *Fov* only: Transplant one clean seedling in each pot from tray 2. The soil is mixed with 20 g of *Fov* inoculum in each pot.

Treatment 4: Silicon followed by *Fov*: Transplant one silicon-primed seedling in each pot from tray 1. The soil is mixed with 20 g of *Fov* inoculum in each pot.

Plants were harvested at 60 DAS. The plant height and dry shoot biomass were measured using the method described in Trial A. Upon harvest, *Fov* infestation was assessed based on vascular discolouration and foliar symptoms. Both leaf and shoot symptoms were assessed as the percentage of total symptomatic tissue out of healthy tissue. All the infected leaves were counted against the total leaves and their proportion was calculated. Similarly, the stem was cut at the soil level and the proportion of infected area within the total vascular section was estimated.

Fig. 6. Vascular discolouration of cotton stem caused by *Fov* infection (a), and foliar wilting symptom of Fusarium wilt caused by *Fov* pathogen (b).

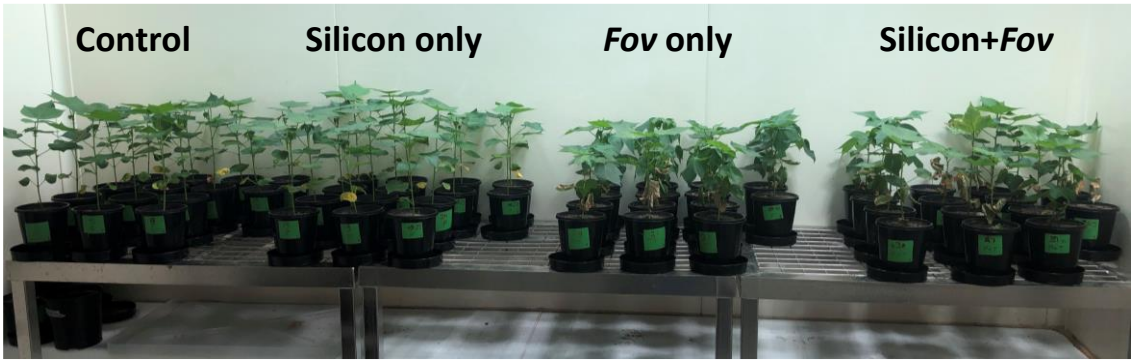

Fig. 7. Cotton plants under different treatments. Stunting of plants caused by *Fov* infection (in *Fov* only and Silicon+*Fov* treatment on the right side) is clearly visible.

Results:

1. *Fov* severity: Silicon priming had no significant effect on the severity of *Fov* infection in the foliar and vascular section (Fig. 8).

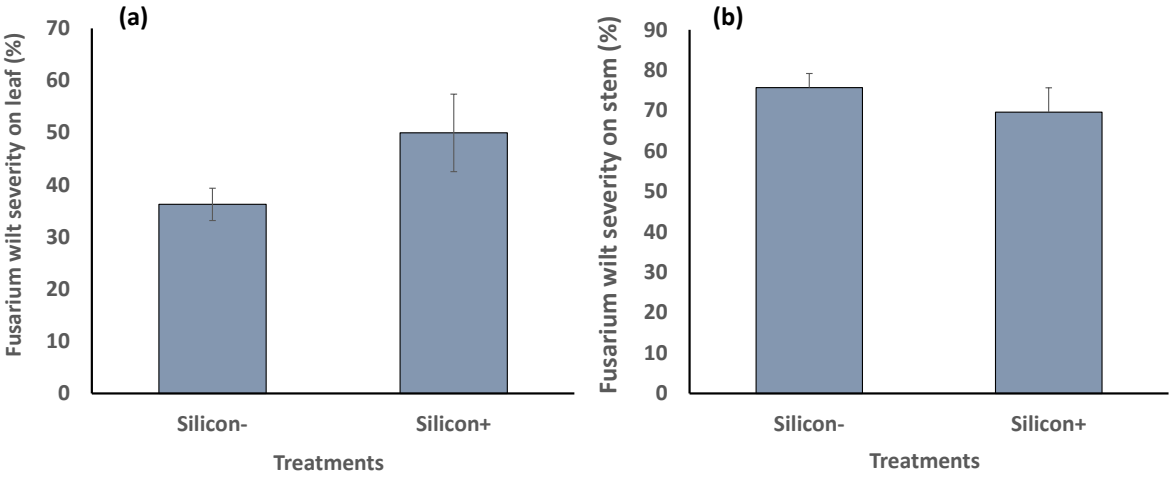

Fig. 8. Fusarium wilt severity as percentage on the leaf and stem discolouration (vascular section) on non-primed (Silicon-) and primed (Silicon+) plants (M ± SE).

2. Plant height and shoot biomass: Silicon priming had no significant effect on plant height or shoot biomass. The *Fov*, on the other hand, significantly reduced plant height (Fig. 9. a) and shoot biomass (Fig. 9. b). There was no interaction between the silicon treatment and *Fov* on any tested plant parameters.

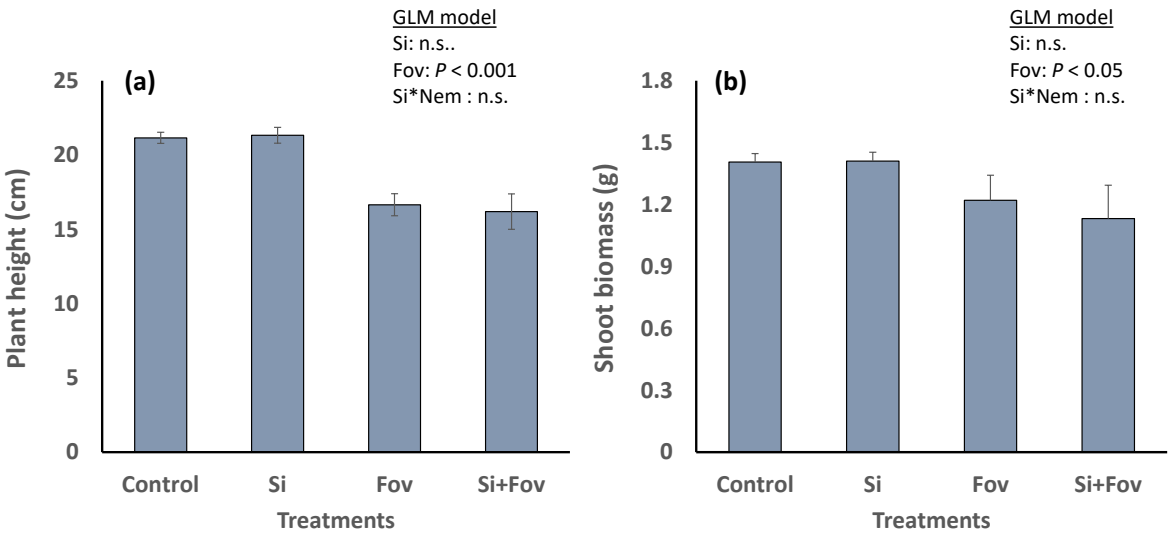

Fig. 9. Average plant height (cm) (a), shoot biomass (g dry mass) (b) of the plants (Mean ± SE), n.s. stands for not significant. Treatments: Control, Si: Silicon only, *Fov*: *Fov* only, and Si + *Fov*: Silicon-primed seedlings were transplanted to the pot inoculated with *Fov* two weeks after sowing.

Trial D: Priming of cotton plant response against Fusarium wilt in the directly sown setting

Background and objectives:

This trial aimed to assess the effect of silicon priming of cotton against *Fov* when it was applied at the time of seed sowing in the direct sowing setting. In this trial, the plants were exposed to the *Fov* pathogens from the first day. I hypothesised that due to the lack of a lag phase or priming period, the priming response of the plants against the *Fov* will not be as evident as in the transplantation setting (Trial C).

Methods and materials:

For this trial, seeds were grown directly in the experimental pots. Four seeds were sown per pot to ensure germination and thinned out to one plant immediately after germination. The silicon treatment and reniform nematode inoculum were added on the day of seed sowing.

There were four treatments as follows:

Treatment 1: Control (No silicon or *Fov*): The experimental pot received water only.

Treatment 2: Silicon only: The experimental pot received silicon on the day of sowing.

Treatment 3: *Fov* only: Seeds were sown into the soil that had been inoculated with 20 g of Millet-based *Fov* inoculum on the same day.

Treatment 4: Silicon plus *Fov*: Seeds were sown into the soil that received the silicon which was also inoculated with 20 g of Millet-based *Fov* inoculum on the same day.

Plants were harvested at 180 DAS. The plant height, dry shoot biomass and *Fov* disease rating were measured using the method described in trial C.

Results:

1. *Fov* severity: Silicon priming had no significant effect on the severity of the *Fov* infection on the stem as estimated as a percentage of vascular discolouration (Fig. 10).

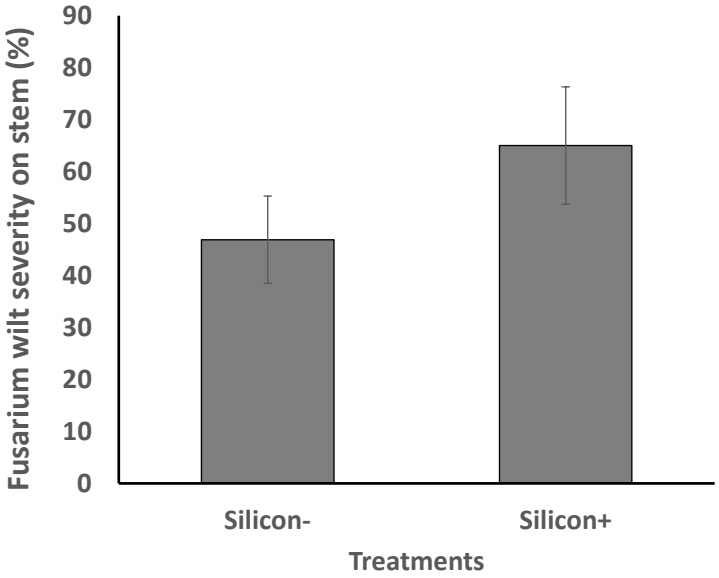

Fig. 10. Fusarium wilt severity as percentage stem discoloured (vascular section) on non-primed (Silicon-) and primed (Silicon+) plants (M ± SE).

2. Plant height and shoot biomass: Both silicon priming and *Fov* had a significant effect on plant height (Fig. 11. a) although there was no interaction between these treatments. On the other hand, there was a significant treatment effect of *Fov* on shoot biomass (Fig 11. b).

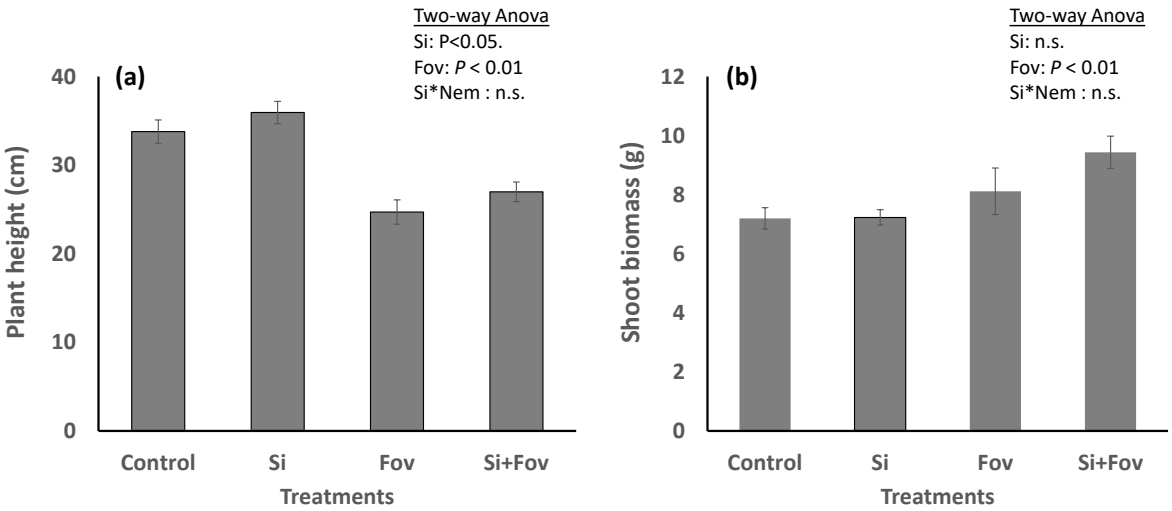

Fig. 11. Average plant height (cm) (a), shoot biomass (g dry mass) (b) of the plants (Mean ± SE), n.s. stands for not significant. Treatments: Control, Si: Silicon only, *Fov*: *Fov* only, and Si + *Fov*: Silicon and *Fov* were added to the soil on the day of sowing.

4. **Benefits to industry** Describe how your industry will benefit from your project results. Have there been any steps already taken with the industry, or plans to engage stakeholders? Are you working with your Award sponsor to reach industry stakeholders?

This project demonstrates that silicon has great potential to be used in the management of plant-parasitic nematodes. This project was the first step in identifying the usefulness of silicon in cotton defence, however additional research is needed to confirm these plant responses are replicable both in the glasshouse and field conditions. In the Australian broadacre farming system, cotton is directly sown to the field; thus, further research is necessary to find a way to treat the cotton crop in the field so that the beneficial effect of silicon can be achieved. Thus, with further field trials and modification in the treatment methods or regime, silicon can be recommended as an additional IDM tool to manage the reniform population in cotton soil. I will continue to work on this topic and will engage the CRDC for additional support for future research. I am hopeful with further research and trials; we can exploit the potential of silicon in plant defence against the reniform nematode.

5. **Budget expenditure** How has your grant funding been expended? (Refer to the budget from your funding agreement and your six-month report). Include details of any unspent funds. A financial acquittal is required at the conclusion of your project. Refer to page one of this report for advice.

Most of the grant was spent to hire climate-controlled cabinets as they required a significant amount of energy to operate. Please refer to the financial acquittal for the details on the expenditure.

6. **Dissemination** Describe the communication activities you have undertaken (eg speaking at external events and seminars, media coverage, contributions to newsletters, journals or published articles etc). How effective were these activities in raising awareness of your project?

I participated in various workshops, meetings, and conferences during the project period. I presented my research plan at the beginning of the project at the online FUSCOM meeting in 2020. I have further discussed research activity with our collaborative partners at NSW DPI, and CSIRO. Most recently, I have presented the results from this research project at the Australian Soil-borne Disease Symposium (ASDS) in August 2022 at Cairns. These activities have been fruitful to disseminate information regarding the reniform nematode research I am undertaking. There is great interest among researchers, agronomists, and growers alike in silicon's potential as an integrated disease management tool. This interest not only in cotton but also in other crops.

7. **Personal benefits** What benefits has this Science Award grant provided you? (eg assisted in career or skills development? presentation skills and opportunities? to continue working in your chosen field of research?)

Being a recipient of the Science and Innovation Award is an honour. It gave me some recognition within my department regarding my research interests and capability and significantly contributed to my progression. This is my first independent research grant; thus, I got the opportunity to familiarise myself with the overall procedure of grant application, contract, variation, milestones, project management, and reporting. This funding allowed me to continue working on the reniform nematode as there is no other research project dedicated to the reniform nematode. This has enhanced my capability and skills in research in plant-parasitic nematodes. More importantly, I got the opportunity to design and conduct innovative research work which may not have been possible without this fund.

8. **Future work** Have you identified any future work opportunities to build on your project outcomes? What will you do in your career over the next 12 months?

As the effect of silicon priming is positive for cotton plants in their defence against reniform nematodes, this project opens the door for follow-up research. Firstly, I will identify if the silicon is absorbed and stored in the root tissue which provides a physical barrier against the reniform nematode. To test this, I will treat the seedlings with silicon as in Trial A and analyse the root silicon content after two weeks of treatment. Following this, I will repeat Trial A with more replicates to confirm this positive effect. These two trials are planned to be completed within the next 12 months. There is additional research planned for the following years. As the effect of the silicon was found in the transplanted cotton, another follow-up research will explore the way to treat the directly sown cotton plants with silicon to have a similar effect. Similarly, I am planning to conduct another trial to see if the silicon application can alter the seed quality so that it can benefit the progeny plants.

The priming response of cotton plants upon silicon treatment in a transplantation setting may also have a wider application for other crops. Many vegetable crops can benefit from the priming of seedlings with silicon as they are usually grown in a nursery before being transplanted to the field. I will disseminate my results to the scientific community of the horticulture industry so that they can explore this as their new IDM tool.

7. **Contact with your Award sponsor** Have you maintained contact with your Award sponsor during your project? Do you intend to continue this contact in the future?

I have maintained a long and continuous relationship with CRDC. I have been primarily involved in CRDC-funded projects over the years, thus CRDC is aware of my research activities including this priming project. My major research interest revolves around cotton diseases and their management which means I will continue to have contact with CRDC in future.

8. Declaration and signature

I certify that the information presented in this report is an accurate statement of my project for the 2020 Science and Innovation Awards for Young People in Agriculture, Fisheries and Forestry.

If not included with this final report, I confirm that a financial statement and a signed statutory declaration will be provided within one month of this final report submission.

Signature:	
Date:	08/10/2022

Return the completed report to the Grants Hub.
For enquiries contact Maree Finnegan, Science Awards Manager, ABARES, GPO Box 858, Canberra, ACT, 2601; Ph: 02 6272 2260 / 0417 689 567 / scienceawards@agriculture.gov.au

Thank you, and we hope that you have found your involvement in the 2020 Science and Innovation Awards to be a valuable and worthwhile experience. We wish you success in the next stages of your career.

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