Insights on adoption of climate smart agricultural practices in Central Australia

Page G, Shekhawat U, Muhammad S

Northern Territory Department of Agriculture and Fisheries, PO Box 8760, Alice Springs, NT 0871. Girija.Page@nt.gov.au

Abstract

Insights from the implementation of a climate smart agriculture project funded by the Northern Hub in the irrigated production systems of central arid region of the Northern Territory (NT) are discussed. Under the project, a one-off material incentive in the form of compost was applied to watermelon and pasture crops to demonstrate the benefits of increased soil organic matter in building climate resilience. Farmers of the watermelon and pasture crops were enthused by the results on moisture retention ability, soil organic carbon content and anecdotal evidence which suggested an increase in yield and quality of the crop from compost application. A potential constraint to the continued use of compost application is the cost associated with long distance transport. Further information on the cost/benefit assessment that includes costs of compost transportation to the farm gate *vis a vis* anticipated increased yields and savings in fertiliser and water is needed for informed decision-making for adoption of the practice. Moreover, discussion on other cultural practices to increase soil organic matter *in situ* such as intercropping/cover cropping will help in the ongoing efforts for increased adoption of climate smart practices for sustainability and profitability in the region.

Keywords

Climate resilience; soil organic matter; irrigated production systems

Introduction

Climate change is one of the key environmental challenges reducing profitability and sustainability of Australian farms. Increase in drought and extreme weather events is putting additional strain on the scarce freshwater resources on which horticultural industry is heavily dependent in Australia. In many parts of the country, poor soils with low nutrients and organic matter, in addition to limited adoption of sustainable practices further constrain efforts to alleviate freshwater use, increase productivity and build resilience to drought. There is also increased expectation to reduce greenhouse gas emissions from the agricultural sector.

Climate smart agricultural (CSA) practices are urgently needed if we are to safeguard the future of Australian agricultural sector. Integration of CSA approach can be an effective way to develop the agriculture sector to enhance sustainable development efforts and help achieve the 17 SDGs (Sustainable Development Goals). A key practice that is a triple win for sustainably increasing agricultural productivity and incomes, building resilience and adapting to climate change and reducing greenhouse gas emissions from agriculture, is the increase in soil organic matter (Amelung et al., 2020).

This project will demonstrate the benefits of building soil organic matter to help transition to climate smart practices in the central arid region of the Northern Territory. Typically, soil organic carbon content of soils in the Northern Territory (NT) is thought to be less than 1% which is considered low. Building soil organic matter (measured as soil carbon) can positively influence productivity, drought resilience and help in climate mitigation and adaptation. Profitability and sustainability of the farm can benefit from transition to practices that build healthy soils. With this premise, a project funded by the Northern Hub was implemented to demonstrate the benefit of building soil organic matter to support adoption of CSA interventions in irrigated production systems in the Alice Springs region of the NT.

Methods

The project undertook 4 interventions to help transition to CSA practices in the region:

1. Stakeholder consultation through workshops: a workshop was organised in Alice Springs to generate awareness on the topic of climate smart agricultural practices and sustainability. Topics included introduction to CSA, interconnections to sustainability, practices under CSA, types of compost and composting and other soil building interventions.
2. Establishment of demonstration sites: two demonstration sites were established (Figure 1), one each near Ali Curung and Ti Tree to demonstrate the benefits of increased soil organic matter on soil nutrient status, soil moisture and crop yields. Industry recommended compost was supplied (5t to

20t/ha) for watermelon and pasture crops and soil samples were collected before and after the project from the treated paddocks (half hectare). The farmers recorded soil moisture with hand-held probes over one growing season for watermelon crop and two cuts for the pasture crop.

3. Outreach through field days: A field day was organised at each demonstration site to share insights on the compost application trial and discuss continuity of the practice.
4. Establishment of adoption sites: two adoption sites were established, one each near Ali Curung and Alice Springs. Compost was provided as a material incentive to help transition to CSA practices.

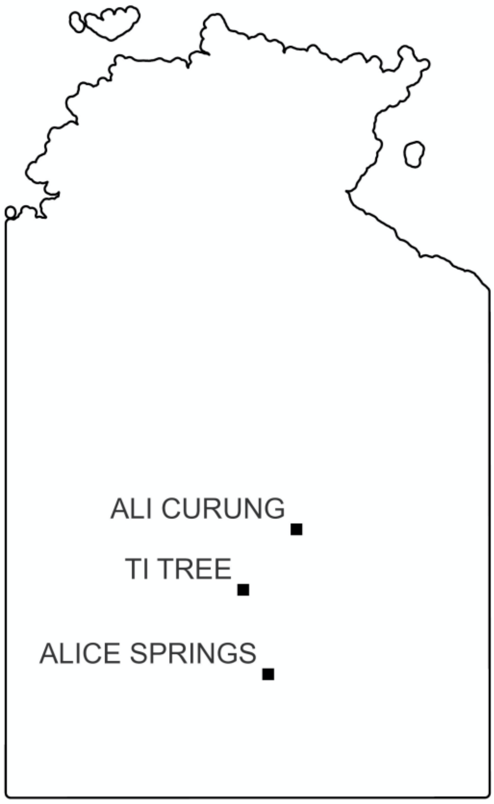

Figure 1. Project sites in the NT

Results

Soil moisture observations recorded by the growers indicated mean higher moisture retention ability with corresponding higher rates of compost application in watermelon and irrigated pasture crop (Table 1). Soil tests undertaken prior to compost application and towards the end of the crop season indicated a trend towards higher soil organic carbon and active carbon content for the watermelon and irrigated pasture crop (Table 2). Anecdotal evidence from the watermelon grower suggested an increase in crop yields up to 10% from compost application. These results were shared during the field days and insights on the continued use of the practice of compost application was discussed. While the growers were enthused and interested in increasing soil organic matter, they indicated the need for more information on the economic feasibility of the use of compost as a source of organic matter. The cost of compost applied at the farmgate including transport ranged from $480 to $750 for each tonne. An anticipated increase of 10% yield for watermelon crop is likely to be sufficient to compensate for the increased costs from higher rates (10t/ha) of compost application. This, together with information on water savings and anticipated reduction in fertiliser use will help in the informed-decision-making on the continuity of the practice of compost application.

Table 1. Soil moisture observations

Watermelon crop

Compost Rate	% Soil moisture				Mean
10t/ha	17.4	17.6	19.2	18	18.05
5t/ha	15.8	16.7	17.1	15	16.15

Irrigated pasture crop

Compost Rate	% Soil moisture									Mean
20t/ha	9.9	10.7	7.5	4.7	16.5	18.3	17.7	7.1	27.3	13.30
10t/ha	10.3	9.3	4.1	4.4	13.2	16.1	17.3	4.7	23.7	11.45
Control	8.4	7.3	3.3	2.1	14.1	17.6	7.7	3.2	17.3	9.00

Table 2. Soil carbon content

Watermelon crop

	Base-line		End-line	
Compost Rate	Active carbon mg/kg	Organic carbon %	Active carbon mg/kg	Organic carbon %
10t/ha	11.4	0.17	271.1	0.55
5t/ha	10.6	0.15	145.5	0.33
Control	61.8	0.22	85.9	0.25

Irrigated pasture crop

	Base-line		End-line	
Compost Rate	Active carbon mg/kg	Organic carbon %	Active carbon mg/kg	Organic carbon %
20t/ha	96.9	0.39	212	0.78
10t/ha	96.9	0.39	257	0.64
Control	95.7	0.41	244	0.62

Conclusion

The project implemented by NT Department of Agriculture and Fisheries demonstrated the benefits of building soil organic matter to help support transition to climate resilient practices in irrigated production systems by educating through workshops, establishing demonstration sites and delivering field days. Empowering and incentivising farmers through practices such as compost application is a positive step towards prioritising soil health and increasing stewardship of land to move towards sustainable agriculture. Although, a broad estimation of the practice of compost application indicated that the increased costs can be met with benefits from increased yields, more information on anticipated savings in inputs such as fertiliser and water will help in informed decision making on the continuity of the practice in the region. Moreover, discussion on other management practices to increase soil organic matter *in situ* such as intercropping/cover cropping is needed for ongoing support to build soil organic matter and transition to CSA practices in the region.

References

Amelung, W., Bossio, D., de Vries, W. *et al.* Towards a global-scale soil climate mitigation strategy. *Nat Commun* 11, 5427 (2020). https://doi.org/10.1038/s41467-020-18887-7.

Acknowledgements

The project 'Increasing adoption of climate smart agricultural practices with a focus on building soil organic matter and water use efficiency' was supported by the Northern Hub, through funding from the Australian Government's Future Drought Fund, and implemented by NT DAF. The authors acknowledge the support of participating growers.