THE BUSINESS CASE FOR HAVING A ROBUST NETWORK OF ON-FARM WEATHER STATIONS IN THE RIVERINE PLAINS

KEY MESSAGES

- **Privately owned, on-farm weather stations provide real-time data that informs and supports decision-making by farmers**
- **A connected, robust regional network of on-farm weather stations has the potential to support decision-making for a wider range of farmers and emergency services**
- **Having access to real-time climate and soil moisture data through on-farm weather stations can provide a range of private benefits to farmers**
- **On-farm weather stations can help inform crop choice at sowing, helping to prevent crop failure in high-risk crops and improve returns from grain marketing; these benefits can increase profit by between $36/ha to $655/ha, with the largest benefit occurring when crop failure in canola is prevented**
- **Public benefits from a weather station network include the prevention of dust storms, achieved by maintaining ground cover, which has an estimated public benefit of $300 million per year**
- **Further work is required to determine the return on investment for how connecting on-farm weather stations through Robust Weather Station Network will increase the sustainability and profitability of grain growers.**

OVERVIEW

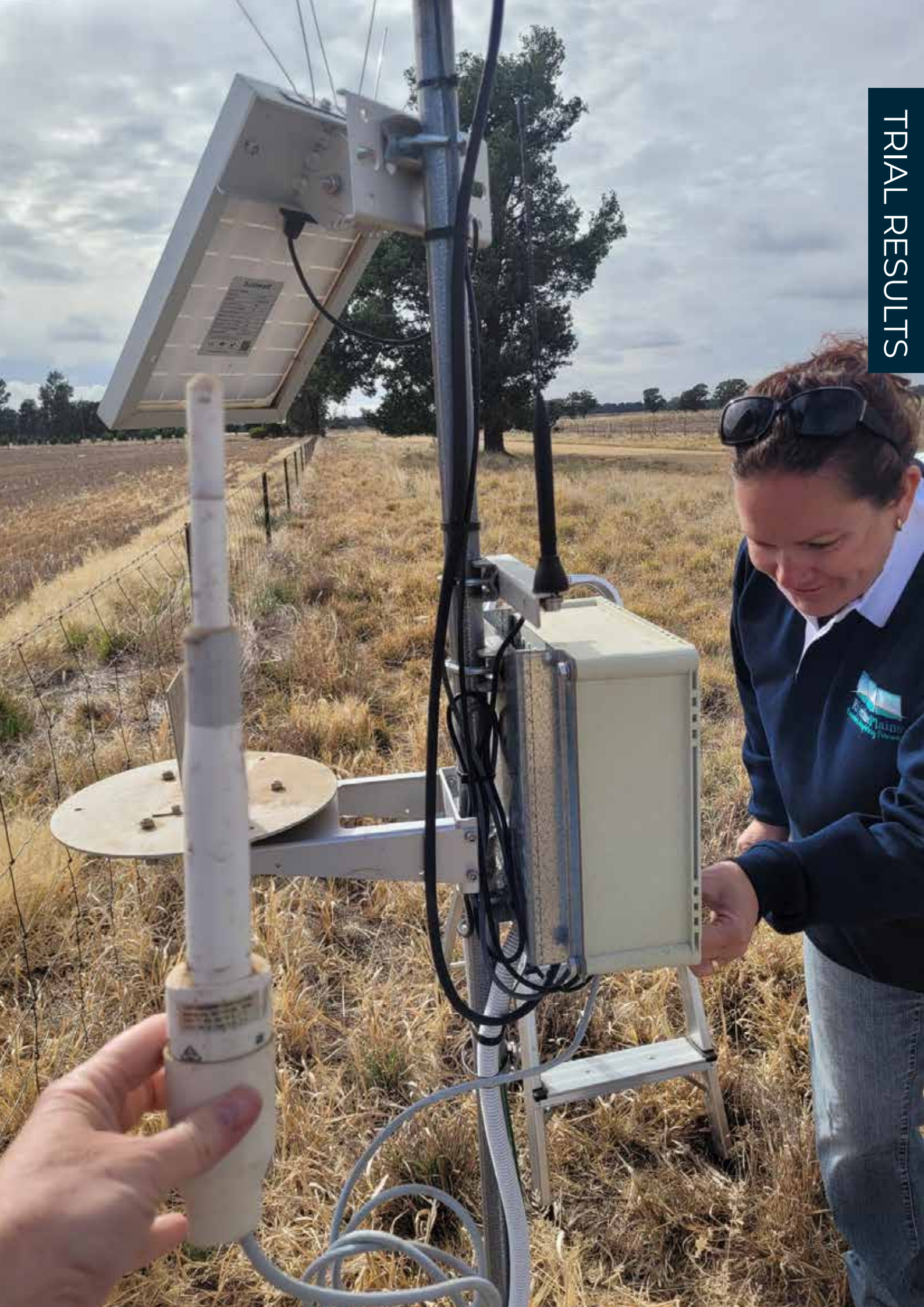
The *Supporting climate resilience through weather stations* project is investigating how an integrated network of 80 on-farm weather stations across central and southern NSW and northern Victoria could better support the community, emergency services and farmers in bushfire and flood management.

Currently, emergency services are reliant on Bureau of Meteorology Weather Stations, which can be located up to 200km apart and do not provide local climate information when fires start. On-farm weather stations have the potential to fill information gaps where no alternative weather information is available.

As part of the project, a business case was developed to evaluate the potential economic and environmental benefits of providing more localised, accurate weather and soil moisture information to farmers and emergency services in the region though the Robust Weather Station Network. The business case compared benefits to baseline information provided by the Bureau of Meteorology. Both qualitative and quantitative data were collected and analysed to provide an estimate of the return on investment for developing a network of weather stations and soil moisture probes.

Consultation conducted as part of the business case development indicated that the Robust Weather Station Network can provide many benefits and opportunities to grain growers, natural resource management organisations and industry bodies. For example, it has the potential to benefit grain growers by assisting with the decision to cut a crop for hay or predict yield to optimise insurance cover. It can also identify likely crop failure based on soil moisture at sowing time and reduce the inaccuracy of yield predictions associated with estimating soil moisture levels.

A more detailed social research study would be



required to further quantify and confirm the benefits of the proposed network outlined in this report.

RESULTS FROM THE BUSINESS CASE

The results presented in this report rely on the use of soil moisture and weather data by growers to improve the on-farm decision making process. This report does not attempt to quantify adoption of the information for use in decision making.

The key economic measures used to indicate the value of the robust weather station network are summarised below, including both private and public benefits.

The **private** benefits to grain growers and close neighbours for using soil moisture data at sowing time include:

- A $267 per hectare return by assisting with the decision to cut a crop for hay
- A $13 per tonne increase in price received for canola by optimising yield predictions for grain marketing
- A $3 – $100 per hectare return from increasing the accuracy of yield predictions for crop insurance
- Up to $504 per hectare return from predicting a crop failure at sowing for wheat
- Up to $516 per hectare return from predicting a crop failure at sowing for barley
- Up to $655 per hectare return from predicting a crop failure at sowing for canola
- A $36 – $143 per hectare return from improving the decision to sow a drought tolerant variety based on soil moisture status at sowing
- A return of $433 per tonne of wheat produced by using soil moisture to predict yield to optimise nitrogen application and reduce greenhouse gas emissions

An example of a **public** benefit from the Robust Weather Station Network is where data is used by farmers to determine likely yield outcomes and help predict when ground cover levels are likely to become low. This information can inform decisions around whether to graze stubbles, cultivate soils and sow crops to increase ground cover in dry conditions and reduce the incidence of major dust storms that can cost up to $300million.

OBSERVATIONS AND COMMENTS

The business case explored the perceived benefits using a range of assumptions. A summary is provided below.

1. **Understanding frost timing and duration, to make more informed decisions.**

   The Robust Weather Station Network would not contribute to reducing losses associated with frost damage in grain production systems, however it could assist with informing the decision-making process should a frost event occur. Determining if a crop has suffered significant frost damage, and therefore whether it should be salvaged by being cut for hay or silage, requires an understanding of the severity of the frost, its duration and the crop growth stage. Having access to accurate local weather information is valuable given the cost of delaying the decision to cut a crop for hay can be as high as $267/ha in reduced income for grain growers.

   Those who are near weather stations would be more likely to be able to accurately make this decision using the data provided.

2. **Making more accurate fertiliser decisions, based on better knowledge of soil moisture conditions.**

   Research shows that the rate of fertiliser application has a greater impact on yield than the timing of fertiliser application. As such, the report concluded that a Robust Weather Station Network would not be expected to contribute to improved fertiliser decision making, because rate is the driver of yield. However, anecdotal evidence from Riverine Plains farmers indicates that soil moisture probe information and climate projections are used to inform fertiliser rates during the season (not presented in the report).

3. **Better yield predictions for grain marketing planning, based on more accurate knowledge of local rainfall and soil moisture conditions.**

   The Robust Weather Station Network would increase the accuracy of yield predictions by growers and advisors. However, a long-term analysis of wheat prices indicates that this

will have little impact on overall profitability for growers. For canola production, there is a potential $13 per tonne benefit from being able to accurately predict grain yield, which could help farmers market their grain earlier.

4. **Better yield predictions for crop insurance planning, based on more accurate knowledge of local rainfall and soil moisture conditions.**

   A study conducted by the Independent Pricing and Regulatory Tribunal (IPART) in 2016 found that although weather stations are unlikely to increase the uptake of crop insurance by farmers, they can assist farmers better prepare for drought. It was found that while improved weather information might improve the accuracy of insurance models, it would not materially reduce the costs of insurance premiums. As such, the benefit of additional weather stations in increasing the uptake of crop insurance was found to be negligible. This study also reported a benefit cost ratio for additional weather stations of 2.3:1, due to the increase in growers' ability to be drought prepared.

5. **More accurate local temperature and wind information to inform farmers of fire risk days, prevent loss from fires at harvest.**

   Data around temperature and fire risk is currently unavailable, however it's hypothesised that improved weather data can be used to increase the accuracy of announcements of high fire risk days, allowing emergency services to plan resources and issue more accurate stop harvest warnings.

6. **Better understanding of soil moisture levels at sowing to inform crop choice.**

   In regions such as central west NSW, knowing the soil moisture status at sowing can help farmers determine whether they should switch to a drought tolerant variety or whether a crop failure is likely. This can help reduce the risk of yield penalties and failed crops, with the value to the grain grower varying from $36/ha in a dry season to $143/ha in a wet season. The decision to sow canola on low soil moisture can cost farmers up to $655/ha, which can be avoided if soil moisture information is used in conjunction with yield prediction models.

7. **Environmental impacts of having better knowledge of soil moisture conditions.**

   The Robust Weather Station Network could be used to assist growers to set a target soil moisture level, which they can then use to inform decisions around whether to graze stubbles, cultivate soils and sow crops. This has the potential to provide an estimated public benefit of up to $300 million, associated with the costs of the clean-up from major dust storms. The Robust Weather Station Network could also reduce the costs associated with crop failure for growers, which can be up to $655/ha for canola.

   Assessing water limited yield and matching nitrogen inputs to this can reduce greenhouse gas emissions that result from excess nitrogen application. This can reduce the carbon footprint of a grain growing business.

CONCLUSION

The outputs of the consultation process and business case development indicate that a Robust Weather Station Network has the potential to provide many benefits and opportunities to grain growers, natural resource management organisations and industry bodies. Collaborative opportunities to expand upon networks, for example those already invested in GRDC, would increase the ability of growers to access and use weather station data to refine their decision making.

The economic benefit of the Robust Weather Station Network to grain growers is centred around increasing the accuracy of weather and soil information, to inform the decision-making process. Further economic and social research is required to determine if the data presented in this business case will achieve the economic benefits stated, as it relies on adoption of the technology by growers to improve the decision-making process.

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