ResilientEP
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FARMER CASE STUDY THEME: STORED SOIL MOISTURE, YIELD POTENTIAL AND HOW TO MITIGATE RISK

Case Study: Using soil moisture data to make targeted decisions relating to inputs and yield potential.

Summary/Purpose

In this case study Andrew Polkinghorne describes the value he has gained from better understanding his soil moisture in absolute terms as well as the characteristics of the soil releasing it. In the past, his nitrogen management decisions were based on crop observations and rotation strategies and some "guesswork." Now armed with data and evidence to show the depth of soil moisture across his paddock, he feels better informed and equipped to make targeted decisions relating to inputs, including nitrogen use and decisions on grain marketing. He can present a more resilient and risk-averse option to finance providers. In addition to sharing his learnings from the project, Andrew is also invested in the challenges faced by the project in sharing the message and beneficial outcomes with other growers.

Context

Andrew's 8000-hectare property, *Kingara Farms,* is near Lock on the central Eyre Peninsula. His enterprise is principally cropping wheat and lentils, as well as barley, canola and faba beans. He was initially interested in the Resilient Eyre Peninsula project because it involved installing soil moisture probes to gain a better understanding of the water storage capacity of soils. At the time, he was looking to achieve a better understanding of his soil characteristics in absolute terms, to be able to make more informed and better paddock decisions relating to nitrogen and to a lesser extent, grain marketing (forward selling).

Approach and methodology

Andrew has continued to carry out normal farming activities on the project focus paddock. A weather station was installed by the Resilient EP project team. EPAG Research agronomist Jacob Giles carried out an intensive soil sampling program across his paddock. From this Andrew learnt a lot about his soils and was particularly surprised by how much the available phosphorus levels varied across the paddock. They

recorded a variance of between 9 and over 105 parts per million, averaging approximately 40 parts per million. This highlighted to Andrew a lot more variation in the paddock than he had anticipated.

Understanding nitrogen management across paddocks has been difficult due to the nature of different soil types. In many parts of his paddocks this would require coring to between 60 cm to a metre below the surface to test nitrogen levels, which he said is "impossible." Instead, he has had to rely on rotations and available soil moisture according to the moisture probe. He said, "decisions are often based on intuition and knowledge of the rotation and crop types and expected rainfall."

Andrew has been particularly happy with the level of involvement he has had in the trial process. He has had direct access to Jacob Giles at EPAG Research and opportunities to discuss the project, his involvement and how the message might be extended to other growers. He has also been able to talk with the project manager, Mark Stanley on occasions where he has had any concerns.

Impact/Benefits

As a result of involvement in the Resilient EP focus paddock, Andrew has gained an improved understanding of soil moisture in absolute terms and the characteristics of the soil releasing it. He said, having the soil moisture probe in the paddock has "reinforced understanding and given us the confidence to install at least one other soil moisture probe on another soil type across our farm."

Based on observations over several years Andrew now knows that if the soil moisture probe says moisture is at 88 millimetres, and there is no prospect of rain ahead, then crops will be going into moisture stress. He also knows that if there is over 100 millimetres, and there are prospects of rain ahead, there will be opportunity to look at nitrogen application as a lower risk opportunity than when it is at 88 millimetres. He understands that if he gets to the latter half of the season (August, September) and there is well over 100 millimetres moisture available, he can forward sell some grain off that paddock with a reasonable degree of confidence that he will be able to meet contracts.

Not only has it been valuable to better understand soil moisture overall, but Andrew has a better sense of soil moisture deeper in the soil profile, which he said has improved his confidence regarding moisture availability. He explained the importance of being able to see soil moisture extraction by crop, and what depth roots are at. He currently has roots down to a metre, which he said is somewhat unusual, but useful to demonstrate where the crop is drawing moisture from. "The benefit is knowing there is a bigger bucket of water for the crop to draw from and we can expect better yields if that is where roots are getting water from."

He noted this had recently been a valuable piece of information to present to his bank. Understanding there is moisture available meant he could confidently show his lender that there is currently more soil moisture available than has been there in the past 5 years. This shows resilience and reduces risk as "they know there is a good probability that we should get a get return on their inputs."

Moisture Probe Network: Andrew highlighted the opportunities available through the network of probes and weather stations attached to this project. The network is sharing information online, allowing for a level of cross farmer learning and a sense of collaboration. Information from moisture probes is publicly available, which means growers can login and view moisture and rain levels, understand how others are responding and decide how outcomes could fit their own systems.

Weather station fire index: The fact that a weather station is fitted with fire danger indexes has been an added benefit, which Andrew said he hadn't expected, but which is really useful. It has been helpful throughout the district due to a local system of high fire danger days. A local committee are tasked with issuing harvest bans when necessary. This halts harvest work for several hours during the riskiest times of the day. Using the fire danger index off the weather stations, they are able to make those decisions and to

call exactly when conditions are safe again. In the past this has been a subjective decision. Now based on data, it is more objective, which takes a lot of pressure off the committee, and they can more accurately issue thresholds where it is too dangerous to harvest.

Knowledge gains: understanding volatile soil types and how to optimise yields

Andrew has gained a lot of insight about his soil type and how to manage his paddocks based on his attendance at the Resilient EP project meetings, where he has had the opportunity to meet with researchers and others involved in the project. He has found the information presented interesting, particularly at the higher level in terms of understanding different models and how to relate and scale information from the soil moisture probes to the rest of his farm.

He has also found considerable value in learning about new and alternative models to help predict soil moisture across his property. For example, using NDVI information to feed into existing models, to help assist decision making relative to soil moisture and zones in paddocks. This was something he previously only had a basic understanding of, and it was not something Andrew had considered.

Andrew explained the capital involved in installing soil moisture probes across an entire farm, would be too costly, which is why he is interested to learn more about nitrogen response or yield response to nitrogen application and relating this back to seasonal conditions at the time. He described new information coming from work being done by Rob Bramley at CSIRO and the interesting possibilities available on how this could be applied to his farm. He is specifically interested in the scalability of knowledge across his property based on understanding variance across soil types.

He also found information from climate scientist Dr Peter Hayman (SARDI) particularly useful. He provided background information on rainfall probabilities as well as explaining what long-range forecasts actually mean: how they are very low probability forecasts, not an actual forecast. These are topics and issues where Andrew has gained a lot of value from his participation in project activities.

Adoption and practice change

Andrew's financial contribution to the Resilient EP focus paddock was towards the weather station installation. In terms of the payoff, he said, "there is no doubt in my mind it has been well worthwhile, and we have got our money's worth back in information, particularly in terms of confidence about nitrogen management."

He explained the investment has enabled more targeted decisions. Using data from the moisture probe has resulted in decisions that have saved on nitrogen applications. For example, costing out urea @ 50 kg/hectare (lower end) and a saving made across 1000 hectare of spreading @ 50 x urea at $1300/tonne, Andrew estimated a saving potential of over $60,000 (depending on the season). He said, on the flip side it might also be an advantage to spend the $60,000, "in the hope we get extra yield back as a result."

Challenges: The only issue Andrew had experienced was regarding yield monitoring equipment. When the trial began, he had one harvester and yield monitor. As his enterprise has grown and he now has two harvesters, there have been instances when the yield monitor in one of his paddocks was not working and information delivered to the project was incomplete. He also has a contract harvester who uses a different yield monitor. While not directly related to this trial, he has experienced technical challenges in integrating data. Jacob (EPAG Research) has helped to interpolate some data, but from a grower point of view, this highlights a need for commonality across systems and reliability of yield monitoring systems.

Relevance to others

Andrew believes the project is extremely useful to scientists and researchers, he said “they've developed a lot of knowledge and information. Just not yet convinced that it's really useful to growers.”

He sees a major challenge for the Resilient EP project as being how to extend project messages to other growers. He feels the goal of the project was to inform growers, to help in making better decisions about their paddocks. Nearing the end point of the project he feels this challenge still exists. He compared the Resilient EP trial outputs to those of projects being run across northern sandy soils of the Eyre Peninsula, which have produced useful information to help growers understand opportunities and risks in terms of cropping inputs, including phosphorus and nitrogen. He suggested the Resilient EP project needs a similar approach in terms of extending information and findings to growers.

He did note the project team had brought in researchers to the area to spend several days demonstrating the conditions and farming systems in the Eyre Peninsula, assessing possibilities for further research. He got the impression this process was extremely useful, and more developments might come out of that.

He is also aware of growers monitoring the output from the moisture probe network online. He feels the public access to information is really good and “gives some degree of confidence as to whether they can relate the information to their soil types.” Andrew said he would strongly encourage other growers to have a look at the information and learn how others have used data and to make their own decisions.

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For the full case study report go to www.airep.com.au