

Rainfall variability trial at Hart in 2022

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Key findings

- Growing season rainfall varied by 14.5 mm (5%) across the Hart field site in 2022. Annual rainfall also varied by 5% (21 mm) with high levels of variation across the site.
- Individual rainfall patterns remained variable, with no location in the paddock recording consistently high rainfall.
- Autumn rainfall was recorded to be the most variable, with a CV% of 13.9%. Winter, spring and summer received the most consistent rainfall, with less variation between locations in the paddock.
- Rainfall variability and inconsistency in spatial distribution of rainfall remain similar across 2021 and 2022, meaning predictable trends are not likely to develop during growing seasons.

Introduction

Rainfall is known to be widely variable across broad agricultural areas. Factors that contribute to variability include rainfall duration, intensity, location and topography. This knowledge can help growers understand where it is more likely for higher rainfall to occur.

The use of remote weather stations, including the Mid-North Mesonet, have become useful tools for growers to track rainfall events and compare measured rainfall against various locations. Variation on a paddock level, however, is not well understood.

This two-year trial aims to identify seasonal trends and capture variability of rainfall differences for individual rainfall events within a single paddock.

Methodology

In 2021, 11 manual rain gauges were positioned across 40 hectares (ha) at the Hart field site. In 2022, there were changes to positioning of some gauges to reflect the change in the location of 2022 trials (Figure 1). Rainfall measurements from all gauges were measured and recorded after each rainfall event.

Rainfall events ranged from 1-5 days, dependent on the persistence of rainfall during this time. This is displayed in Table 1, showing that 34 rainfall events were recorded manually at Hart, compared to the Mesonet's recording of 112 days of rainfall.

All gauges were calibrated in 2021, prior to the first rainfall event, ensuring the volumetric capacity of water (mm) was consistent for measurement accuracy. Events under 0.4 mm were not recorded.

Rainfall at the Hart field site was mapped using a GIS program to display rainfall patterns for each event, through inverse distance weighted (IDW) interpolation maps (Figure 2).

The variability of autumn, winter, spring and summer rainfall, growing season rainfall (GSR), annual rainfall and individual rainfall events was measured.

Table 1. Growing season and annual rainfall summary for the 2022 season at Hart. Rainfall data was sourced from the [Mid-North Mesonet](#).

	Rainfall (mm)	Decile
Annual rainfall	519	10
Growing season rainfall (GSR)	355	8
	Mesonet (rainfall days)	Manual gauges (recorded rainfall events)
Number of recorded rainfall events	112	34

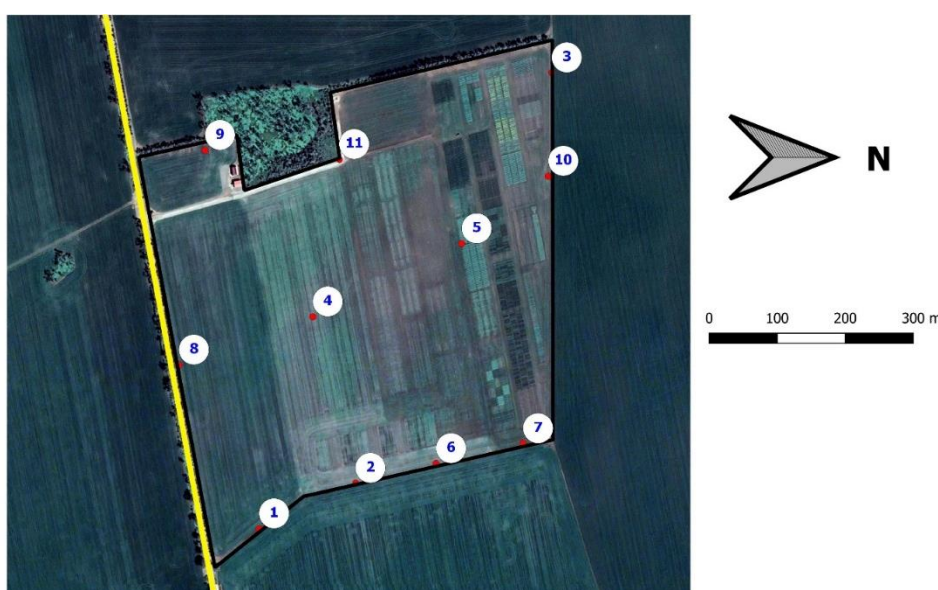


Figure 1. Location of manual rain gauges positioned across the Hart field site in 2022.

Results and discussion

Growing season and annual rainfall

During 2022, a total of 34 rainfall events were recorded, with 24 of these events occurring during the growing season. Annual rainfall at Hart in 2022 was 425 mm with a GSR of 288 mm across all 11 rain gauges. Growing season rainfall varied by 14.5 mm (5%) across all gauges (Figure 2). This volumetric difference is similar to what was observed in 2021, with 17 mm difference across the 40 ha site at Hart (Anderson & Allen 2021).

Annual rainfall varied by 21 mm (5%), with the highest amount of rainfall received in the south-west corner and northern fence line (Figure 3). The lowest amount of rainfall was recorded near the middle of the southern fence line.

The close proximity of high and low rainfall areas in 2022, continue to indicate high spatial variability of rainfall.

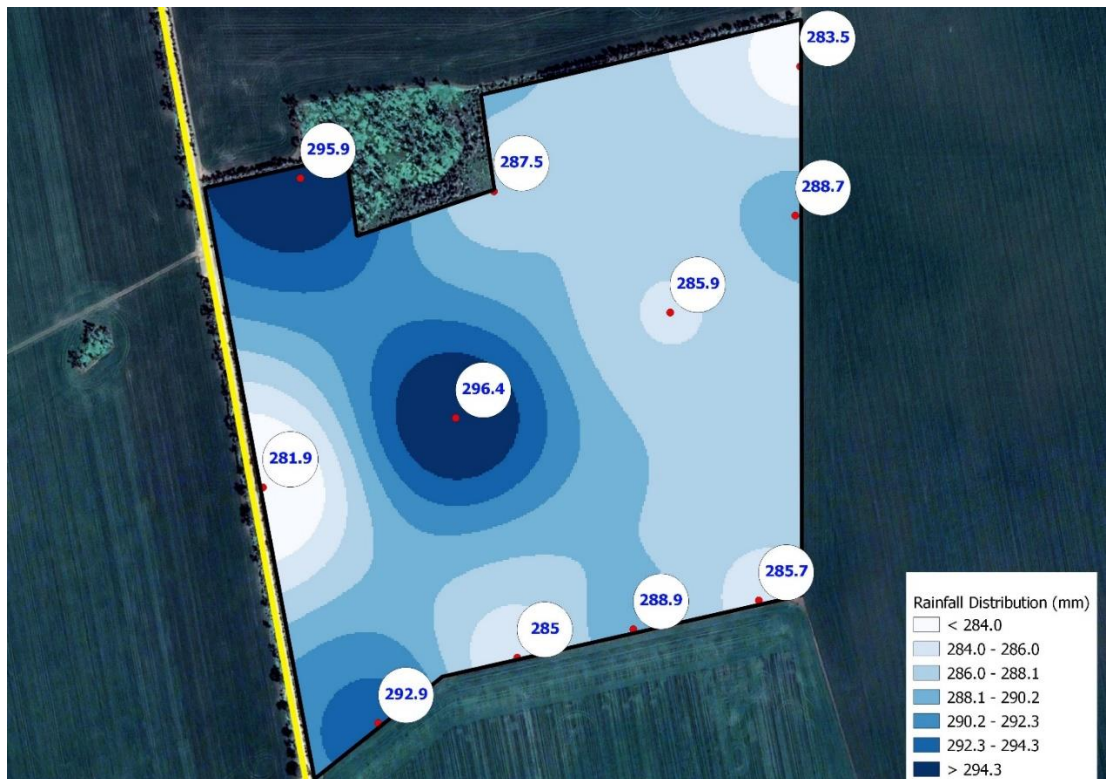


Figure 2. Distribution of recorded rainfall for the duration of the 2022 growing season (April – October) for each gauge at Hart.

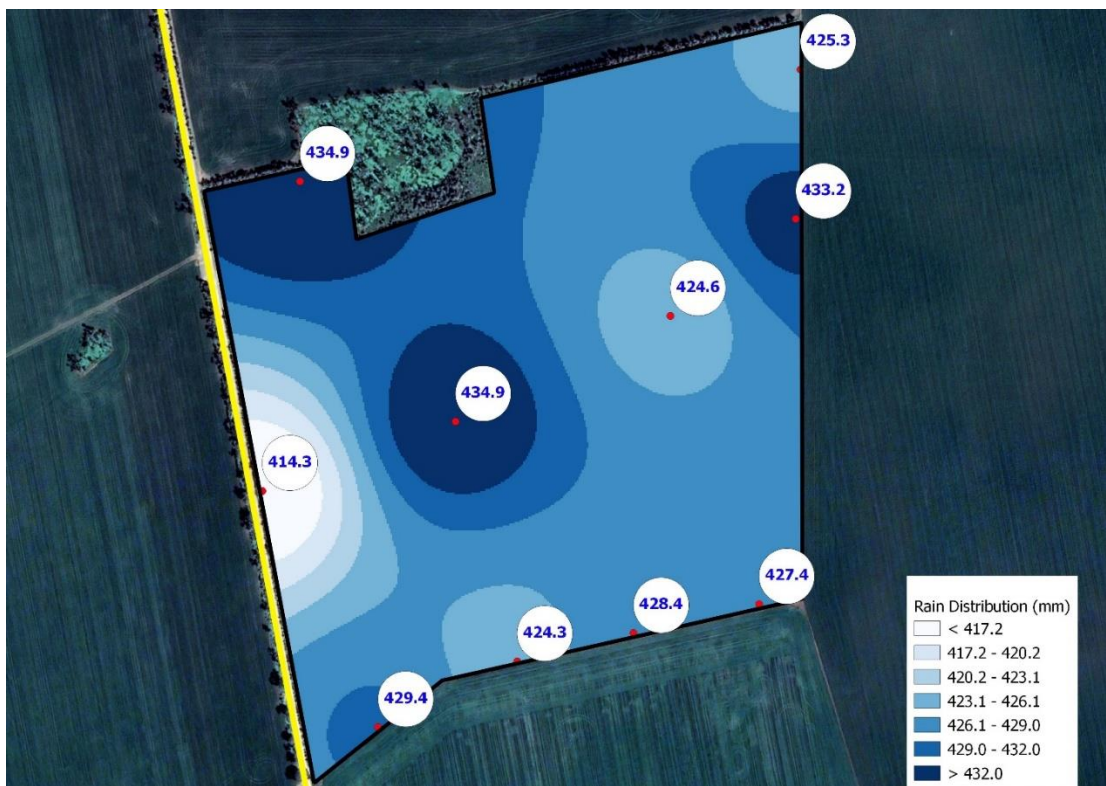


Figure 3. Distribution of recorded rainfall for 2022 for each gauge at Hart. Gauge 11 not present due to missing values.

Comparison of single rainfall events

A high coefficient of variation (CV%) was recorded for rainfall events of less than (<) 5 mm when compared to events over 5 mm.

This results in larger differences between rain gauges when smaller rainfall events are observed. This is supported by the percentage (%) difference between highest and lowest recorded amount in each rainfall event. Events that were < 5 mm varied by 12-48% between the highest and lowest recorded rainfall across gauges (data not shown). The variability of rainfall across gauges was lower in 2022 when compared to 2021. This was likely a result of an increase in average rainfall per event in 2022, averaging 12.7 mm compared to 7.8 mm in 2021.

Rainfall that was greater than (>) 5 mm had a lower difference (%) between high and low recordings with events averaging 15% between gauges compared to 31% when < 5 mm (data not shown).

When rainfall events of similar volume were compared, the spatial distribution of rainfall still varied greatly, as shown in Figure 4 and Figure 5. The rainfall patterns suggest that there are no paddock locations that consistently record higher levels of rainfall. Across both years of this trial, there has been no spatial trend observed, meaning assumptions of where rainfall is going to be higher cannot be made for Hart.

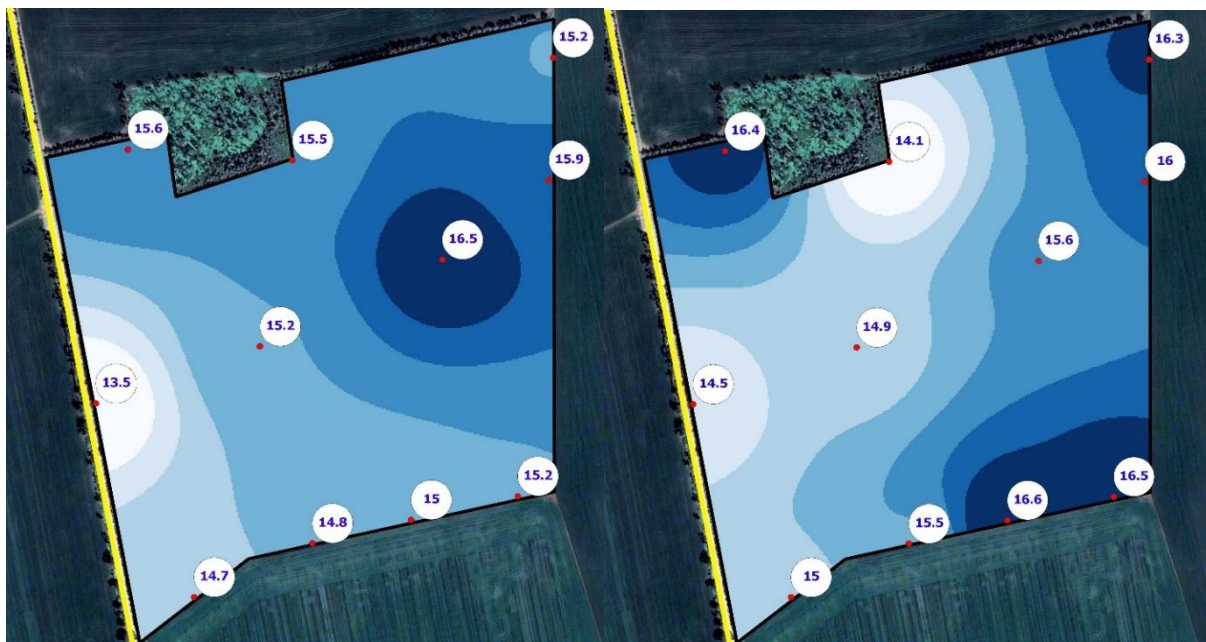


Figure 4. Rain distribution maps of two 15 mm rainfall events on June 27 (left) and December 23 (right) at Hart in 2022.

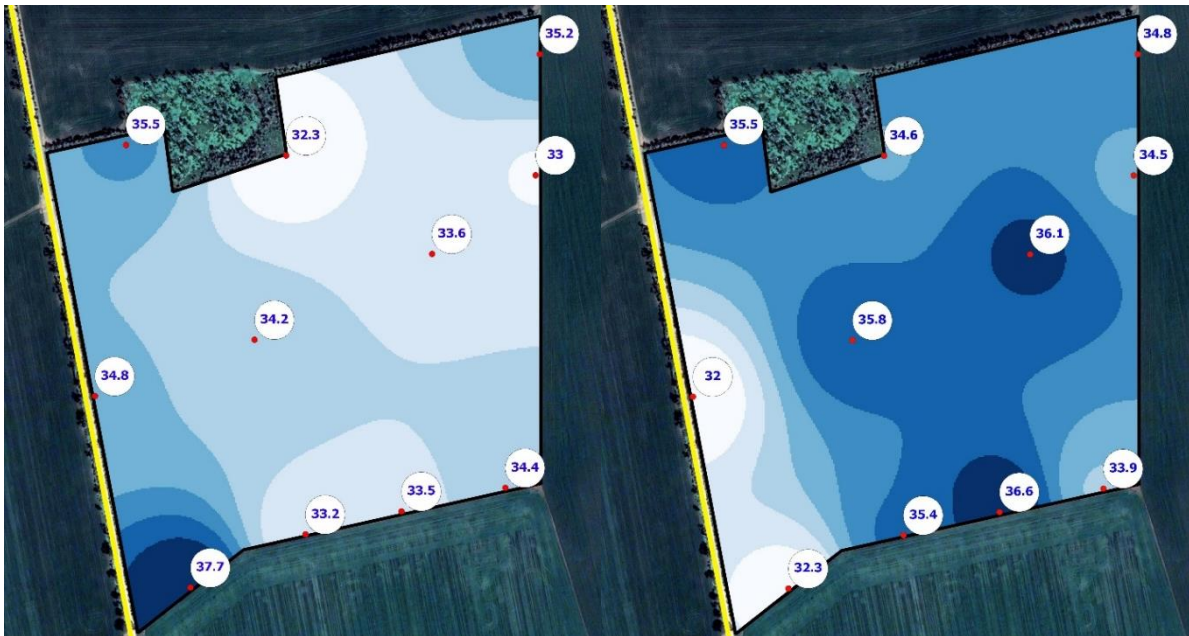


Figure 5. Rain distribution maps of two 35 mm rainfall events on May 31 (left) and October 26 (right) at Hart in 2022.

Rainfall variability across seasons

As expected, the volume of rainfall was different across seasons, with low recordings of 51 mm in autumn, and high rainfall of 246 mm in spring (Table 2).

Similar to 2021 observations, winter and spring had the most consistent distribution of rainfall with low CV% (variability) of 8.1 and 3.4 respectively. Summer months in 2022 also had consistent rain distribution with a CV% of 5.3 (Table 2).

As observed in 2021, autumn recorded a high rainfall CV% across the 11 gauges, suggesting that differences in rainfall across a paddock would be greater than in other seasons.

Table 2. Seasonal rainfall data including coefficient of variation (CV%), rainfall event average (mm), rainfall days and total seasonal rainfall (mm) for Hart in 2022. Rainfall data sourced from the [Mid North Mesonet](#).

	Autumn	Winter	Spring	Summer
CV%	13.9	8.1	3.4	5.3
Event average	3.7	2.9	6.6	7.3
Rainfall days	14	41	37	14
Total season rainfall (mm)	51.2	120.0	246.4	101.6

Rainfall distribution for each season across the Hart field site was variable (Figure 6). There are no similarities between corresponding rainfall distribution maps in 2021 or 2022 (Anderson & Allen 2021). This suggests there are not predicable rainfall distribution patterns for each season at Hart.

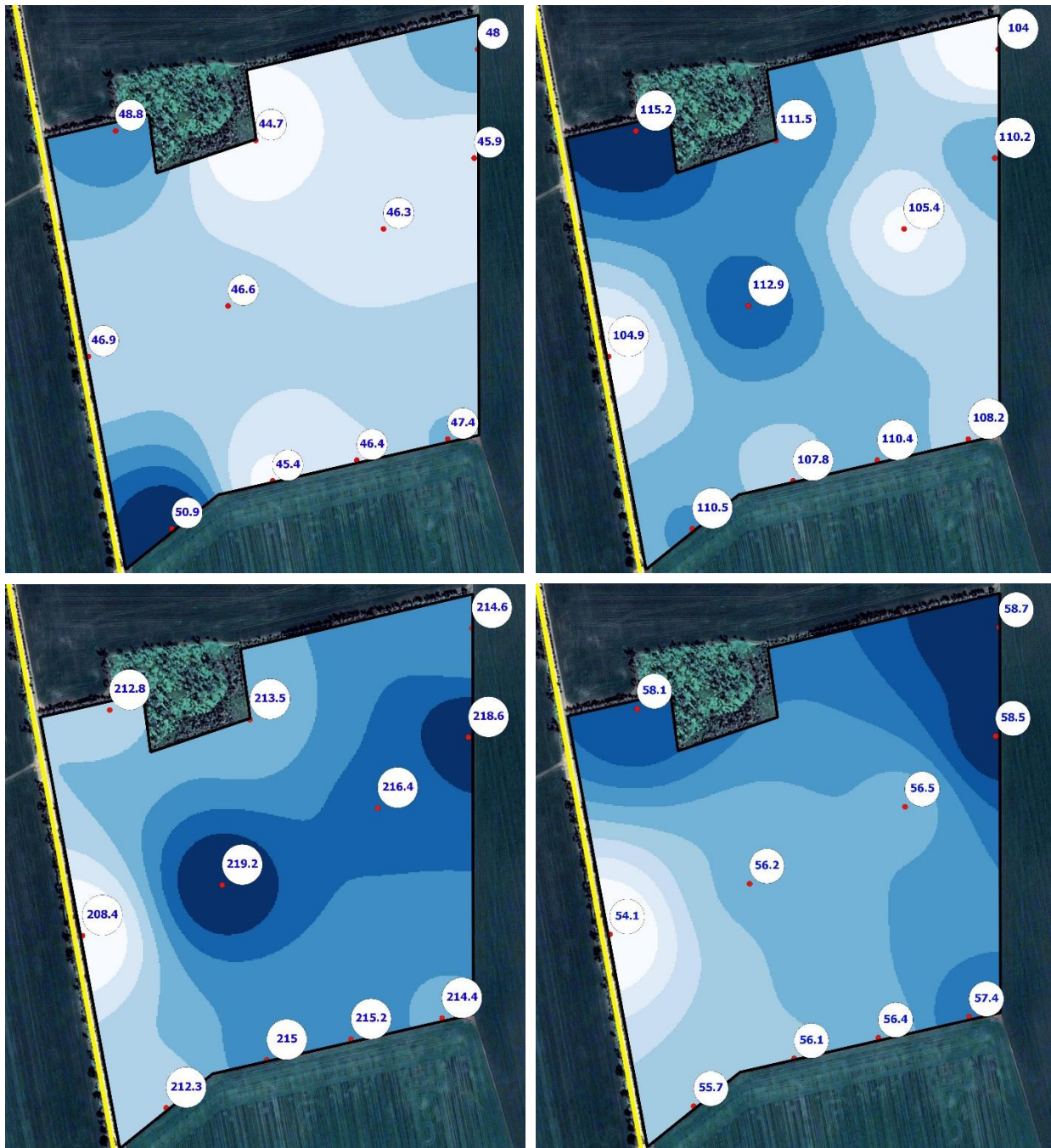


Figure 6. Rainfall distribution maps for autumn (top left), winter (top right), spring (bottom left) and summer (bottom right) at the Hart field site in 2022. Dark blue shading represents greater rainfall areas and white areas indicate lower rainfall.

Acknowledgements

The Hart Field-Site Group would like to acknowledge the generous support of our sponsors who provide funding that allows us to conduct this trial. Proceeds from Hart's ongoing commercial crop also support Hart's research and extension program.



References

Anderson D and Allen R 2021, 'Rainfall variability at Hart in 2021'
<https://www.hartfieldsite.org.au/pages/resources/trials-results/2021-trial-results.php>