RESOURCES FOR COTTON GROWERS ON SIPHONLESS LAYOUT DESIGNS, IMPLEMENTATION AND AUTOMATED MANAGEMENT USING SMART IRRIGATION TECHNOLOGIES

IMAGE: GRANT OSWALD

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CASE STUDY: Getting the most from your Siphonless System

TAILWATER BACKUP AND INLET SPACING

Two of the most common factors affecting irrigation efficiency in siphonless systems are tailwater management and inlet spacing. Getting this right at the design stage has a significant impact on water use, pumping costs, and irrigation run times. This factsheet explains the benefits of tailwater backup and uses a worked example to illustrate the consequences of insufficient flow from poor inlet spacing, and the gains from incorporating tailwater backup into the design for a pipe through the bank system.

Advantages of tailwater backup

Siphonless systems that have tailwater back up incorporated in the design have many advantages over a siphon system. For an overview of which system types include tailwater backup, see Factsheet 2: Types of Siphonless Systems.

» Reduced tailwater losses through continuous re-use through bays

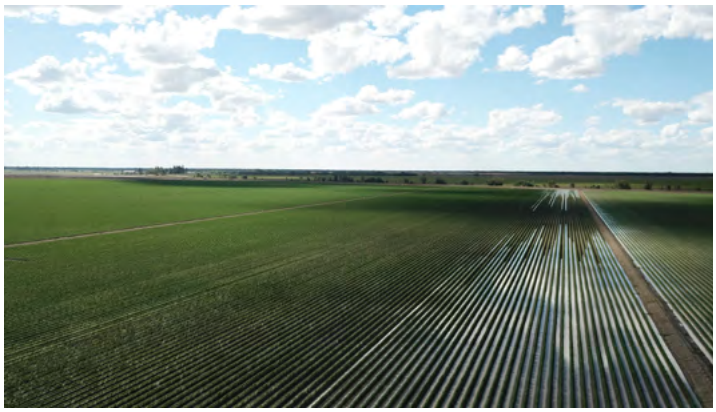

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Figure 1: Example of Tailwater Backup to improve water efficiency, reduce application time, silt and trash buildup in tailwater recycling and reduce time to irrigated farm.

» Application time is reduced due to the high flowrate and the reuse of tailwater. The tailwater runoff reduction accelerates the speed of the irrigation event.
» Silt buildup in the tailwater recycling system is reduced. Silt build-up in a siphon system and

PTB system is a result of scouring in the last 50m of the furrow as the water accelerates down the batter into the tail drain.

» Trash accumulation in the tailwater recycling system is reduced due to the reduced tailwater volume.

A worked example for Pipe Through the Bank (PTB) layouts

This example shows the impact spacing inlets too far apart in a PTB layout, and quantifies the benefits of incorporating TWB. All bays are supplied with 50ML/day flow, have 1000m furrow length and soil water deficit is 60mm. Scenarios are extrapolated across a 400ha farm.

Result:

Increased run times with insufficient flow:
Increasing inlet spacing from 144m to 176m with same flow rate reduces irrigation advance rate from 49 ha/day to 42 ha/day. For a 400ha farm the whole farm irrigation time is extended from 8.2 days to 9.5 days and the total water delivery is increased from 411ML to 473ML. The extended runtime increases tailwater from 41% to 49% and is likely to increase deep drainage losses.

Inlet spacing and tailwater backup have a significant impact on whole-farm irrigation efficiency.

Benefit of tailwater backup: In Scenario C, when tailwater backup is included in the design of a PTB system, the tailwater volume decreases from 5.94 ML to 1.78 ML, and the irrigation run time is shortened to 5 hours. The irrigation will advance at a rate of 69 ha/day compared to 49ha/ day. An irrigation cycle on a 400ha farm will be completed in 5.8 days with a total of 289ML of water delivered.

Where to from here?

Inlet spacing and tailwater backup have a significant impact on whole-farm irrigation efficiency. Getting these decisions right at the design stage is critical to maximising the return on your siphonless investment. See the Siphonless Irrigation Factsheet Series for more information on successful siphonless planning and development.

Scenario A: PTB with adequate flow
Supply of 50 ML/day to a 144m wide section (14.4 ha), with run time of 7 hours.

Scenario B: PTB with inlet spacing too far apart and insufficient flow
The same 50ML/day supply across 176m wide section (17.6ha). This bay is 22% wider. If uniformity is unchanged the irrigation time would be 8.55 hr, but the reduction in even flow rates between furrows would add another 1.5 hours. Total run time is 10 hours.

Scenario C: Pipes with Tailwater Backup
Supply of 50ML/day to a 144m wide section (14.4 ha) with tail water back up. The back up of tailwater reduces the run time from 7 to 5 hours.

	Section Width (m)	Bay size (ha)	Run time (Hrs)	Profile Refill (deficit x area) (ML)	Applied volume (run time/24 x flow) (ML)	Tailwater Volume (applied volume- profile refill) (ML)	Advance rate (24hr / run time x bay size) (ha/day)	Farm irrigation time (400ha / advance rate) (days)	Farm water delivery (50ML/day x farm irrigation time) (ML)
A	144	14.4	7	8.64	14.58	5.94 **(41%)**	49	8.2	411
B	176	17.6	10	10.56	20.83	10.27 **(49%)**	42	9.5	473
C	144	14.4	5	8.64	10.42	1.78 **(17%)**	69	5.8	289

Table 1: A Worked example for PTB layouts on inlet spacing and advantages of tailwater backup

Footnotes

[1] Small PTBs still require two-meter rotobucks. Whilst offering labour saving benefits, they retain most similarities to manual hand siphon systems and therefore are excluded from general siphonless system comparisons in this guide.

[2] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[3] Grower Case Study 'Norwood' Moree. CottonInfo, 2024.

[4] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[5] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[6] Siphonless irrigation guide. Smarter Irrigation for Profit, 2019.

[7] Irrigation systems, designs and scheduling options. GVIA. 2022.

[8] Grower Case Study 'Norwood' Moree. CottonInfo, 2024.

[9] Bankless channels- Bullamon Plains. More Profit Per Drop. 2011.

[10] WATERpak a guide for irrigation management in cotton and grain farming systems. CRDC. 2012.

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CONTRIBUTORS:

Matt Champness led the project and developed the smart irrigation content, with review and editing of siphonless system design content. **Harriet Brickhill** developed the siphonless systems content and provided review and editing of smart irrigation technologies content. **Glenn Lyons** provided technical input and review of siphonless system content.

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REPORT LIMITATIONS

This guide is an educational resource that has collated current information on siphonless irrigation systems and smart irrigation technologies. It provides general layout designs and description of terms to guide discussions between industry and best practice principles for planning and developing new layouts. However, this information is not prescriptive. Performance outcomes and benefits are site-specific and will vary based on individual farm conditions, management capacity, and technology choices. Growers should adapt this information to their specific circumstances.

Smart irrigation technologies are rapidly evolving. Inclusion of specific products, features, photos and suppliers does not constitute endorsement. Growers should conduct their own due diligence before making investment decisions.