# Efficient irrigation in the nursery

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23rd Annual IPPS Conference
3-5 March 2020

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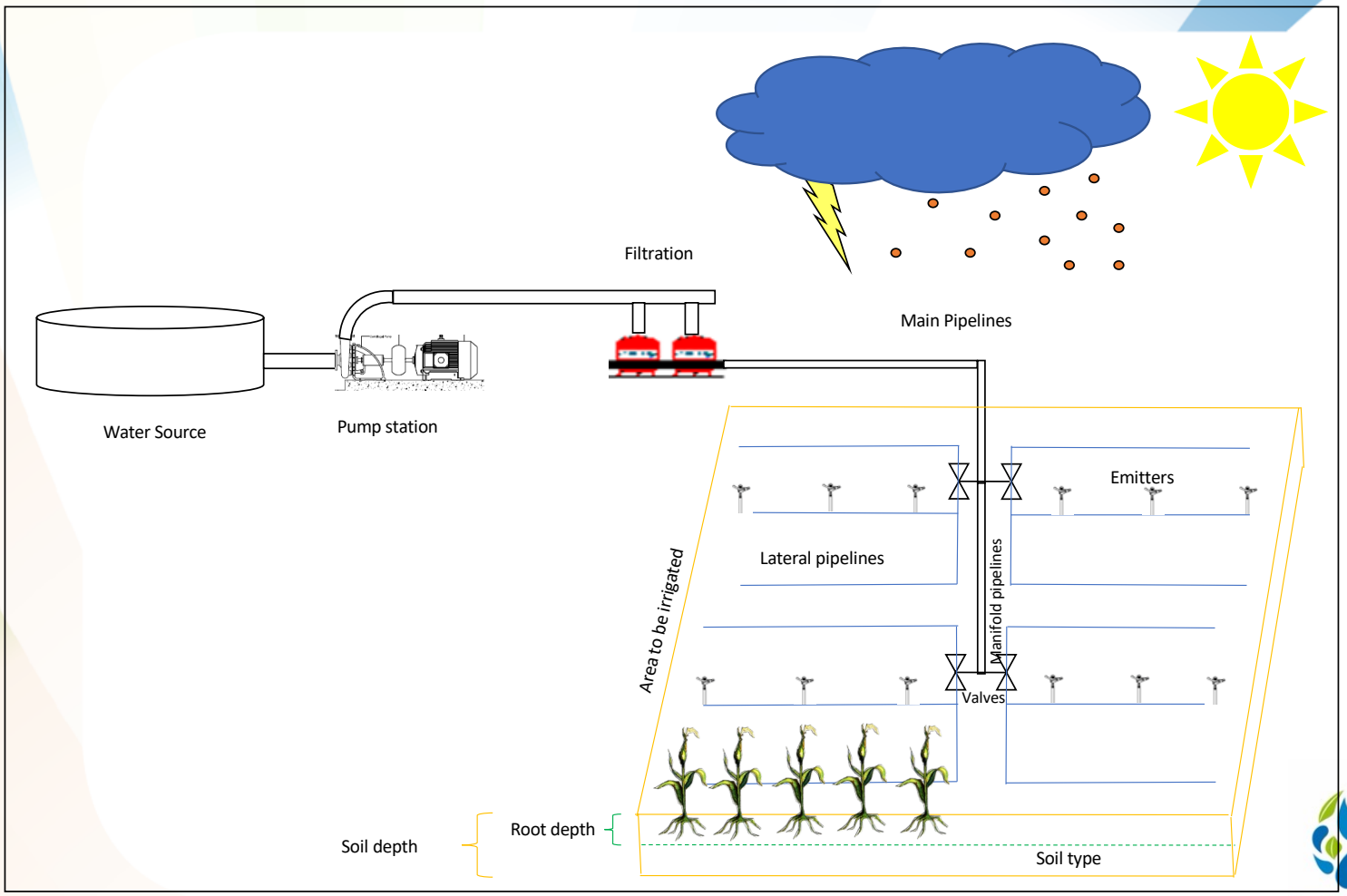
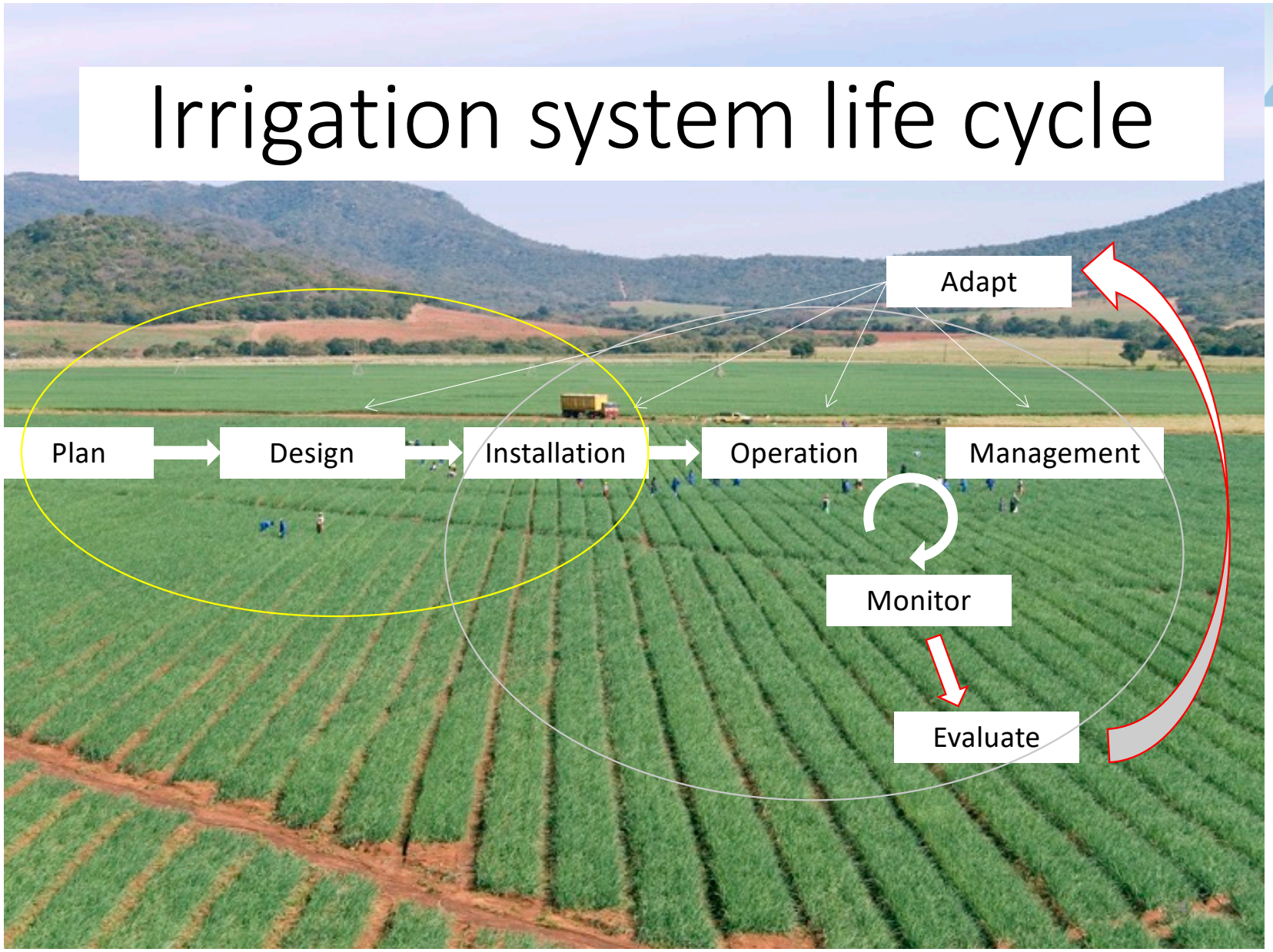
# Components of an irrigation system:

- Water source (with water flow meter)
- Pump & motor/ gravitational feed
- Filtration system
- Main line (high pressure)
- Valves (manual/ automatic)
- Manifold/ branch (lower pressure)
- Laterals
- Emitters (Sprinkler/boom/mini sprinkler/micro sprinkler/ drip/ hand)


Filtration
Main Pipelines
Water Source
Pump station
Emitters
Lateral pipelines
Area to be irrigated
Manifold pipelines
Valves
Soil depth
Root depth
Soil type

# Irrigation system life cycle



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# Uniformity

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# Pumps

# Water meters


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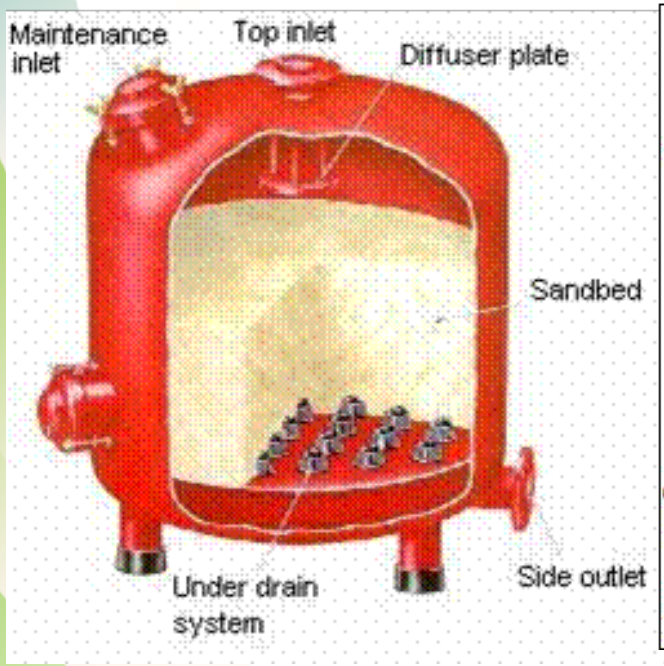
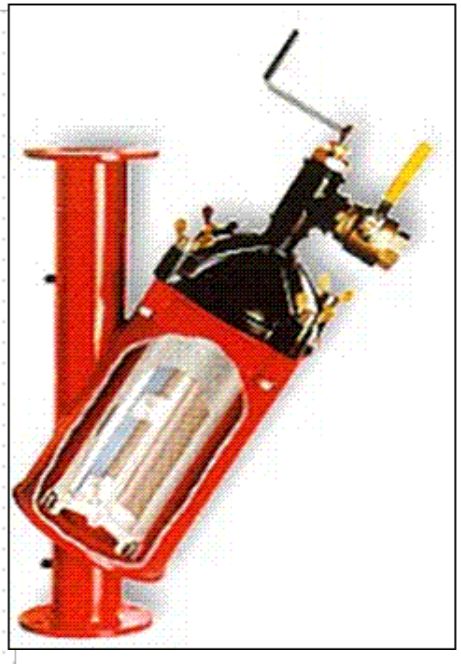
# Filtration

- Needed for micro irrigation because the small openings through which water must move blocks easily because of impurities in the water.
- Pre-filtration might be necessary
- Different size and type of filters are available
- The size of the filter is determined by the flow that needs filtering
- Maintenance is important

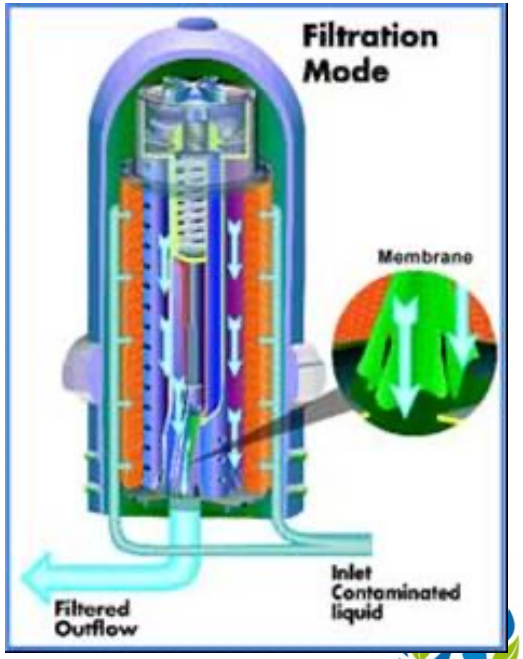
## Sand




## Mesh

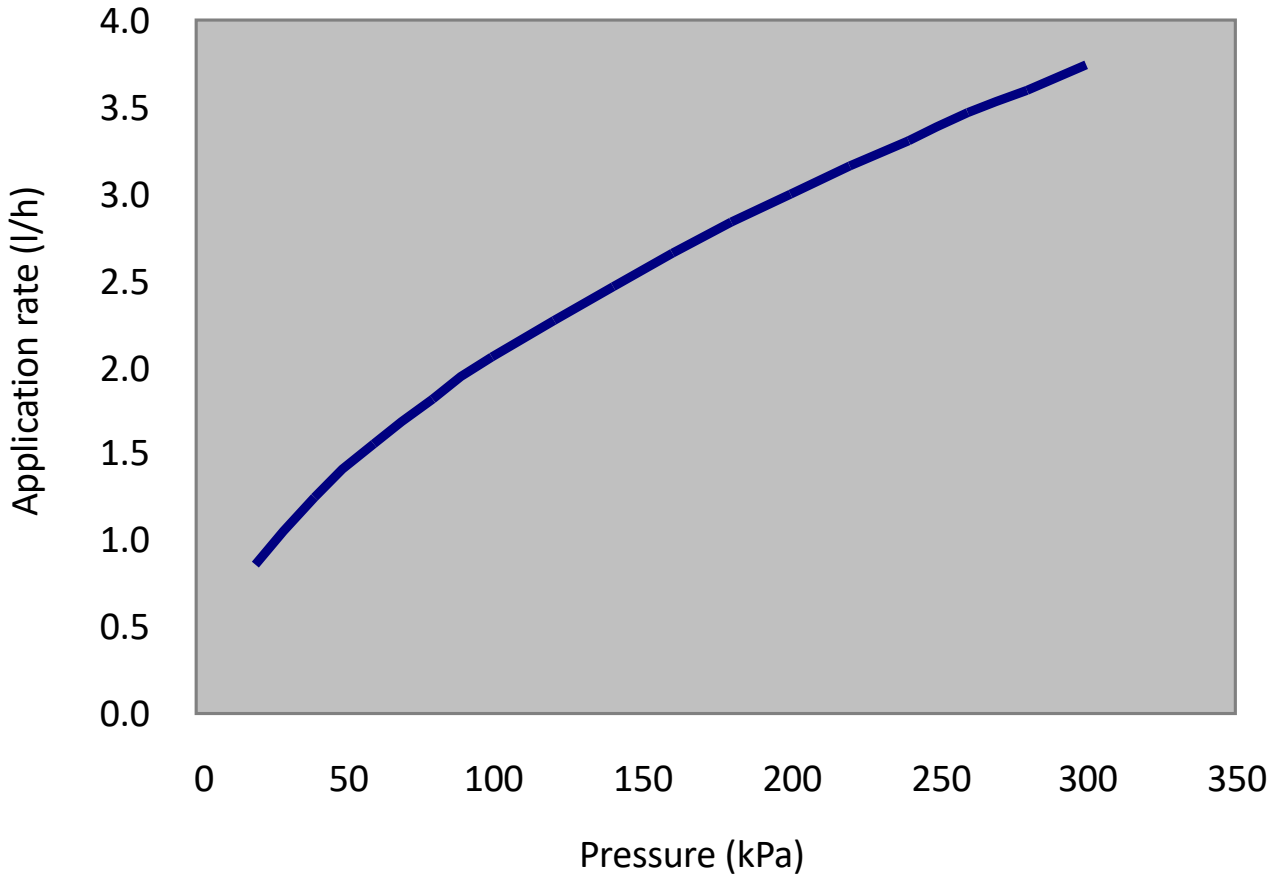


## Disk

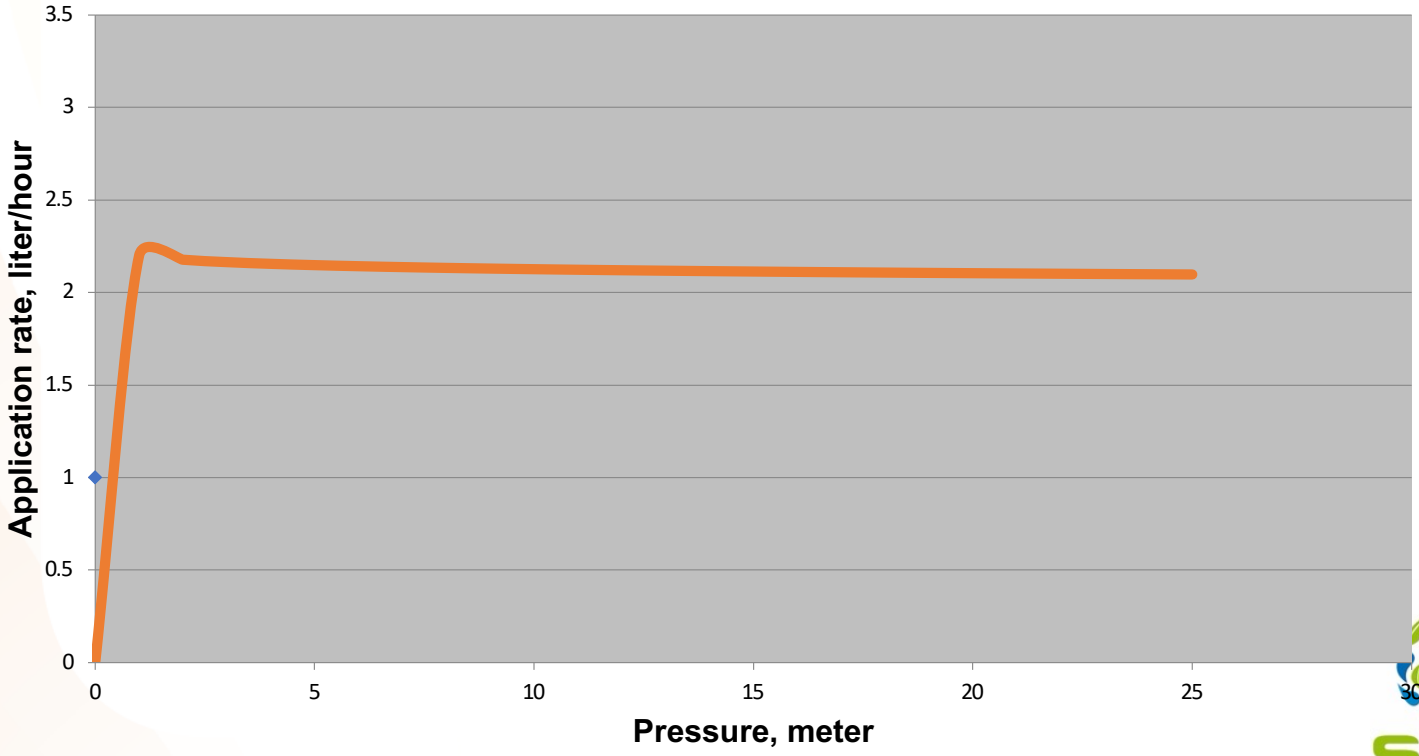


# Filter bank

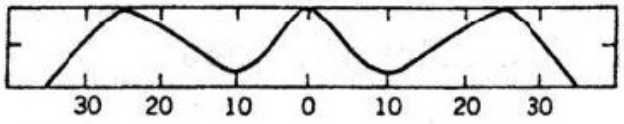
# Pressure-sensitive emitter



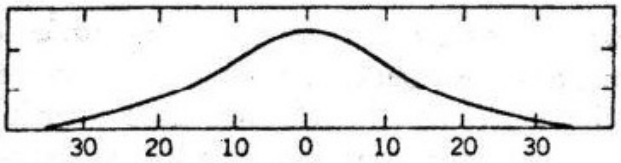
# Pressure compensated emitter (or emitter with pressure regulator)



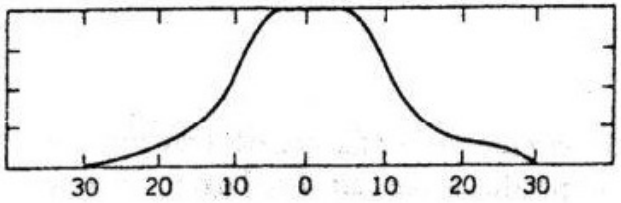
# Influence of pressure on distribution




(a) Low pressure

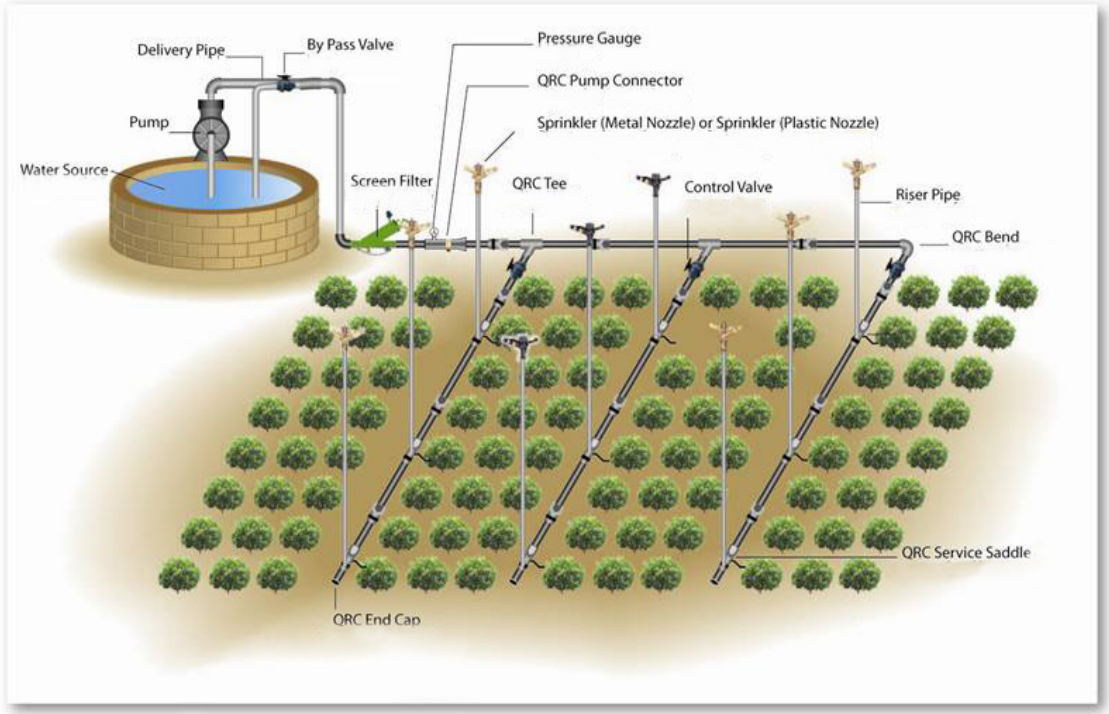



(b) Correct pressure



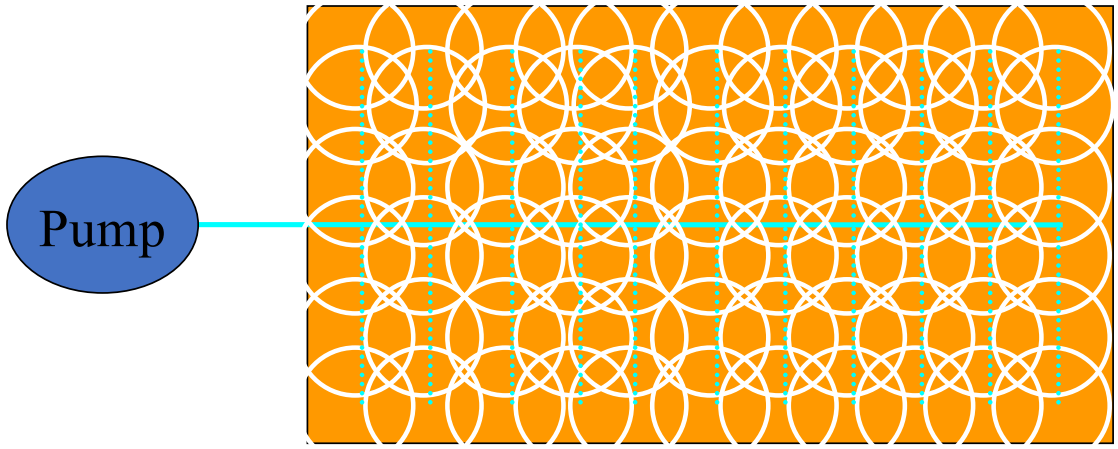

(c) High pressure

# Permanent Sprinkler System




Layout of Sprinkler Irrigation System

# Static Sprinkler - Permanent System

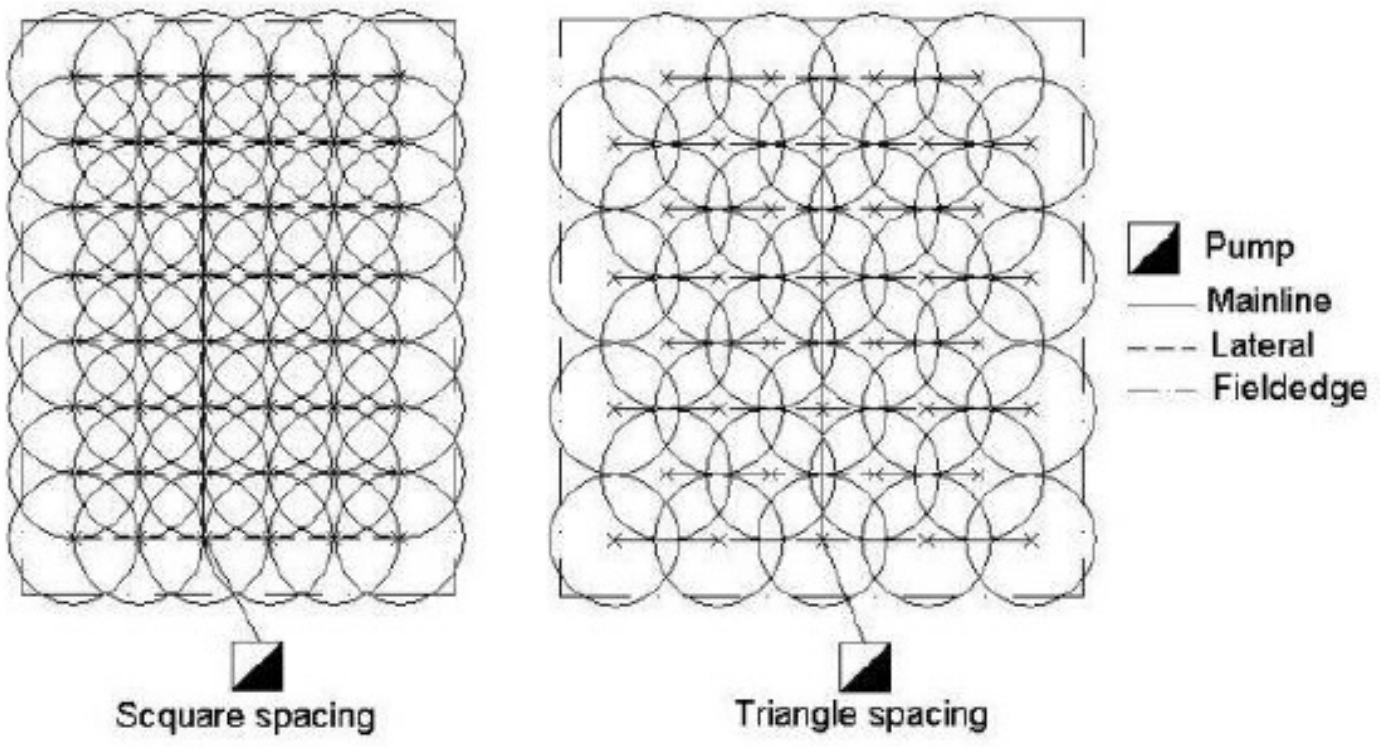


# Impact sprinklers (application 700 – 5000 l/h)



18

# Wetted area overlap



## *Sprinkler specification and performance table*

| Diameter nozzle (mm) | P 2.5 bar | P 3.0 bar | P 3.5 bar | P 4.0 bar | P 4.5 bar | P 2.5 bar | | P 3.0 bar | | P 3.5 bar | | P 4.0 bar | | P 4.5 bar | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Casting range (m) | | | | | | Recommended distance between sprinklers (m) | | | | | | | | | |
| 3.5** | 8.0 | 8.4 | 8.9 | 9.5 | 10.1 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 |
| 3.8 | 8.5 | 9.0 | 9.5 | 10.0 | 10.5 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 |
| 4.0 | 8.9 | 9.4 | 9.9 | 10.4 | 10.9 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 |
| 4.2 | 9.0 | 9.6 | 10.0 | 10.6 | 11.1 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 |
| 4.5 | 9.2 | 9.8 | 10.4 | 10.8 | 11.2 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 | 15x13 | 12x12 |
| ZA 7 / ZA 7 W Water consumption Q ($m^3/h$) | | | | | | ZA 7 Precipitation* (mm/h) | | | | | | | | | |
| 3.5** | 0.69 | 0.75 | 0.82 | 0.87 | 0.92 | 3.5 | 4.8 | 3.8 | 5.2 | 4.2 | 5.7 | 4.5 | 6.0 | 4.7 | 6.4 |
| 3.8 | 0.81 | 0.89 | 0.96 | 1.03 | 1.09 | 4.2 | 5.6 | 4.6 | 6.2 | 4.9 | 6.7 | 5.3 | 7.2 | 5.6 | 7.6 |
| 4.0 | 0.90 | 0.99 | 1.06 | 1.14 | 1.21 | 4.6 | 6.3 | 5.1 | 6.9 | 5.4 | 7.4 | 5.8 | 7.9 | 6.2 | 8.4 |
| 4.2 | 0.99 | 1.09 | 1.17 | 1.26 | 1.33 | 5.1 | 6.9 | 5.6 | 7.6 | 6.0 | 8.1 | 6.5 | 8.8 | 6.8 | 9.2 |
| 4.5 | 1.14 | 1.25 | 1.35 | 1.44 | 1.53 | 5.8 | 7.9 | 6.4 | 8.7 | 6.9 | 9.4 | 7.4 | 10.0 | 7.8 | 10.6 |
| ZA 7 D Water consumption Q ($m^3/h$) | | | | | | ZA 7 D Precipitation* (mm/h) | | | | | | | | | |
| 3.5x2.4 | 1.01 | 1.11 | 1.20 | 1.28 | 1.36 | 5.2 | 7.0 | 5.7 | 7.7 | 6.2 | 8.3 | 6.7 | 8.9 | 7.0 | 9.4 |
| 3.8x2.4 | 1.14 | 1.24 | 1.34 | 1.44 | 1.52 | 5.8 | 7.9 | 6.4 | 8.6 | 6.9 | 9.3 | 7.4 | 4.0 | 7.8 | 10.6 |
| 4.0x2.4 | 1.22 | 1.34 | 1.45 | 1.55 | 1.64 | 6.3 | 8.5 | 6.9 | 9.3 | 7.3 | 10.0 | 7.9 | 10.8 | 8.4 | 11.4 |
| 4.2x2.4 | 1.32 | 1.44 | 1.56 | 1.66 | 1.77 | 6.8 | 9.2 | 7.4 | 10.0 | 8.0 | 10.8 | 8.5 | 11.5 | 9.1 | 12.3 |
| 4.5x2.4 | 1.46 | 1.60 | 1.73 | 1.85 | 1.96 | 7.5 | 10.1 | 8.2 | 11.1 | 8.9 | 12.0 | 9.5 | 12.8 | 10.1 | 13.6 |

Water consumption: ℓ/h  Wetted diameter: øm  1m³/h = 1 000ℓ/h

## VYRSA 56 NYLON SPRINKLER

- Full circle
- 20mm - 3/4" male BSP
- Popular spacing 18 x 18m

**Coefficient of uniformity (Cu)**

- 84% on 18 x 18m – 3/16 x 1/8 @ 3.5bar
- 85% on 18 x 24m – 13/64 x plug @ 4bar
- 86% on 30 x 27mΔ – 3/16 x plug @ 3bar

| Pressure | Nozzle size | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1/8" 3.2mm | | 9/64" 3.6mm | | 5/32" 4.0mm | | 11/64" 4.4mm | | 3/16" 4.8mm | | 13/64" 5.2mm | |
| Bar | ℓ/h | ø m | ℓ/h | ø m | ℓ/h | ø m | ℓ/h | ø m | ℓ/h | ø m | ℓ/h | ø m |
| 2.5 | 620 | 26.8 | 790 | 28.4 | 970 | 30.2 | 1160 | 31.0 | 1390 | 31.8 | 1640 | 32.6 |
| 3.0 | 680 | 27.4 | 860 | 28.8 | 1050 | 30.6 | 1270 | 31.8 | 1510 | 32.8 | 1790 | 33.8 |
| 3.5 | 740 | 27.8 | 930 | 29.4 | 1140 | 31.2 | 1380 | 32.4 | 1640 | 33.6 | 1930 | 34.8 |
| 4.0 | 790 | 28.2 | 1000 | 29.8 | 1120 | 31.6 | 1470 | 32.8 | 1750 | 34.0 | 2060 | 35.6 |
| 4.5 | 840 | 28.6 | 1060 | 30.2 | 1290 | 32.0 | 1550 | 33.2 | 1860 | 34.4 | 2180 | 36.0 |
| 5.0 | 880 | 29.2 | 1120 | 30.6 | 1360 | 32.4 | 1640 | 33.6 | 1960 | 35.0 | 2290 | 36.4 |
| 5.5 | 930 | 29.6 | 1170 | 31.0 | 1430 | 33.0 | 1720 | 34.2 | 2060 | 35.4 | 2380 | 36.8 |

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# MegaNet Sprinkler with “Road Guard”

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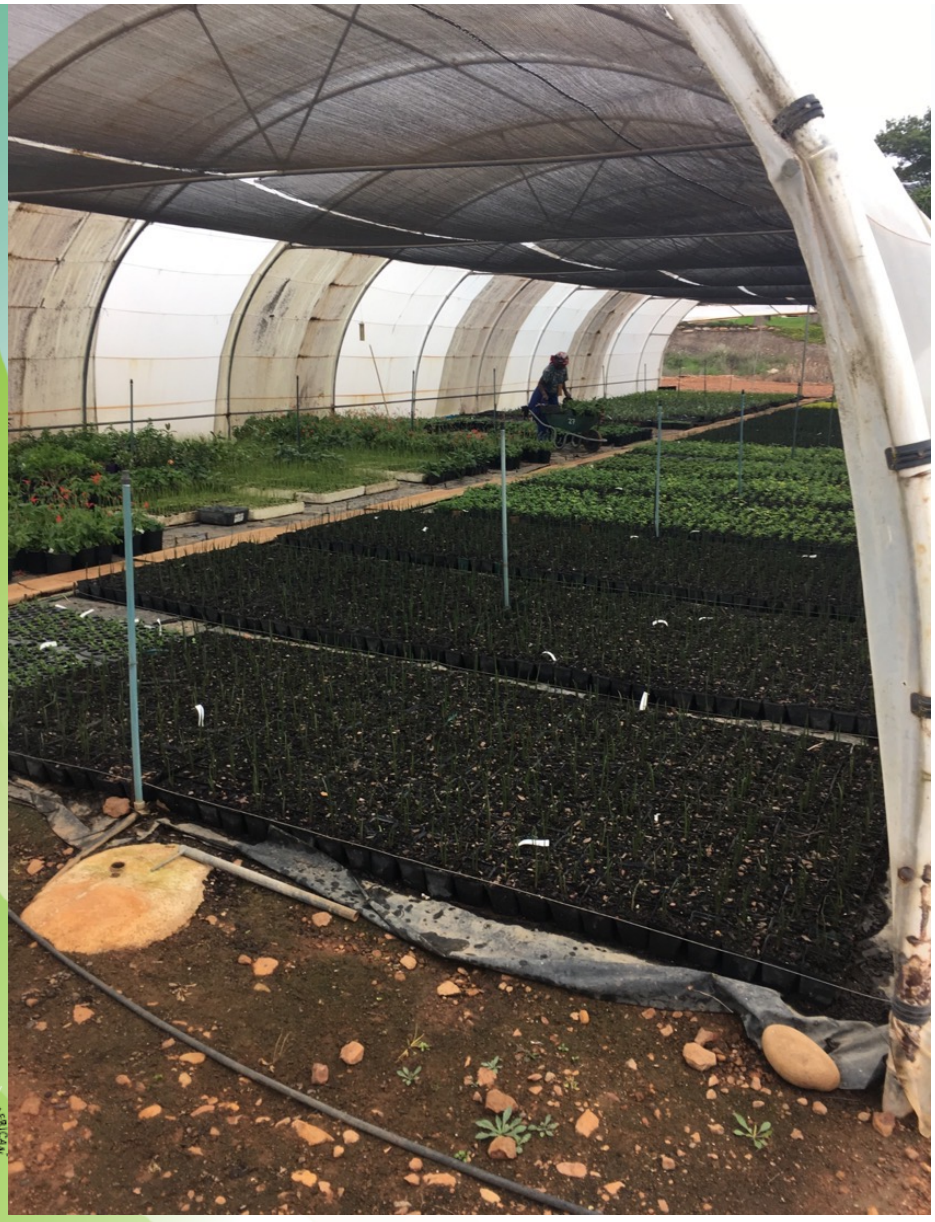

- Fixed arc
- Variable arc
- Rotating
- MPR (Matched precipitation rate)



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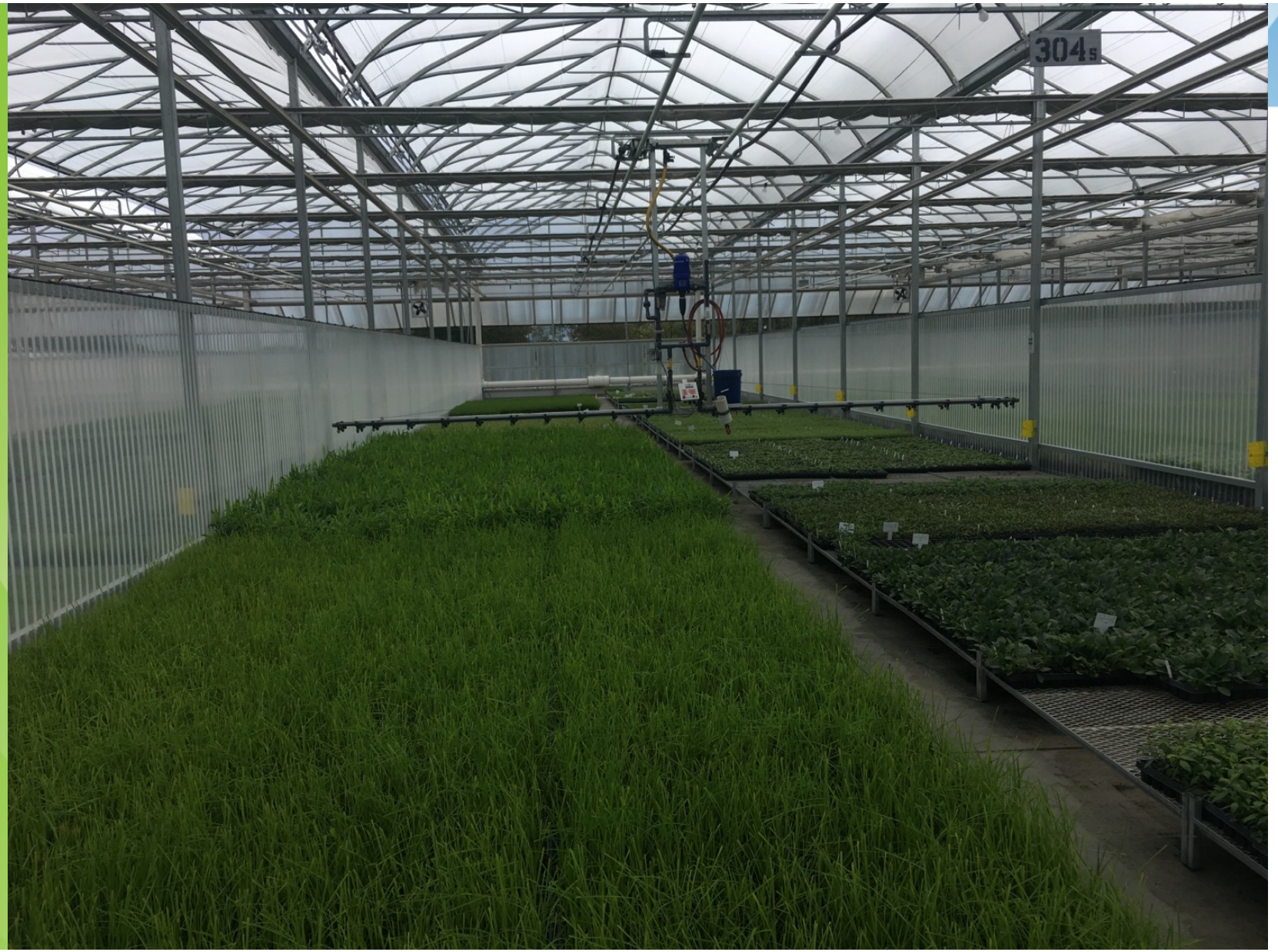


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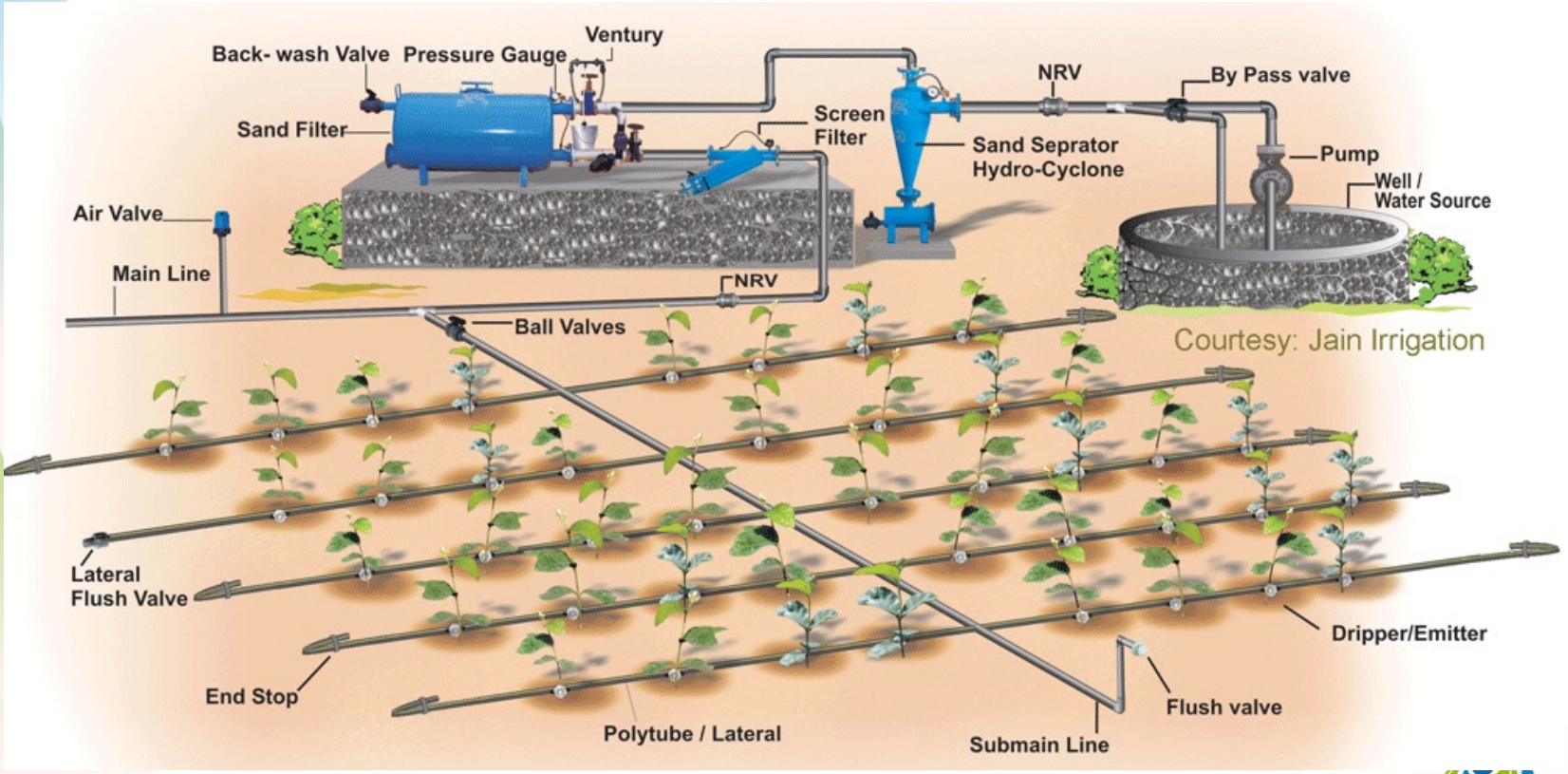


# Micro irrigation layout

# Mikro-sprinklers (Application 20 – 300 l/h)

# Pressure compensated micro-sprayers

## Body

A-type

G type


# Nozzle sizes

| COLOUR | ORIFICE SIZE |
|---|---|
| Black | 0.8mm (• 030") |
| Blue | 1.0mm (• 040") |
| Green | 1.3mm (• 050") |
| Red | 1.5mm (• 060") |

# Drip
# (Application 1 – 24 l/h)

# Button Drip Installation

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# SpinNet Sprinkler

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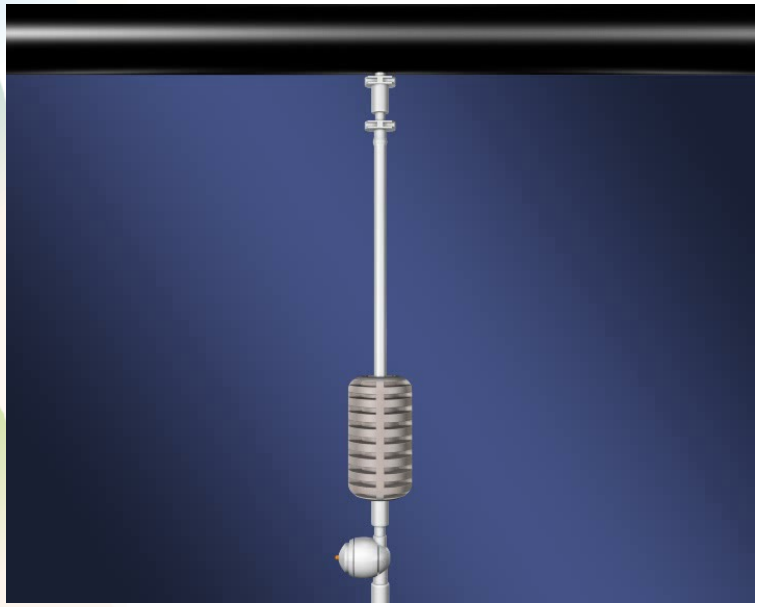
SpinNet

# Anti Drain




A D Valve

# CoolNet

Very small water drops  - 65 micron

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# Hand watering


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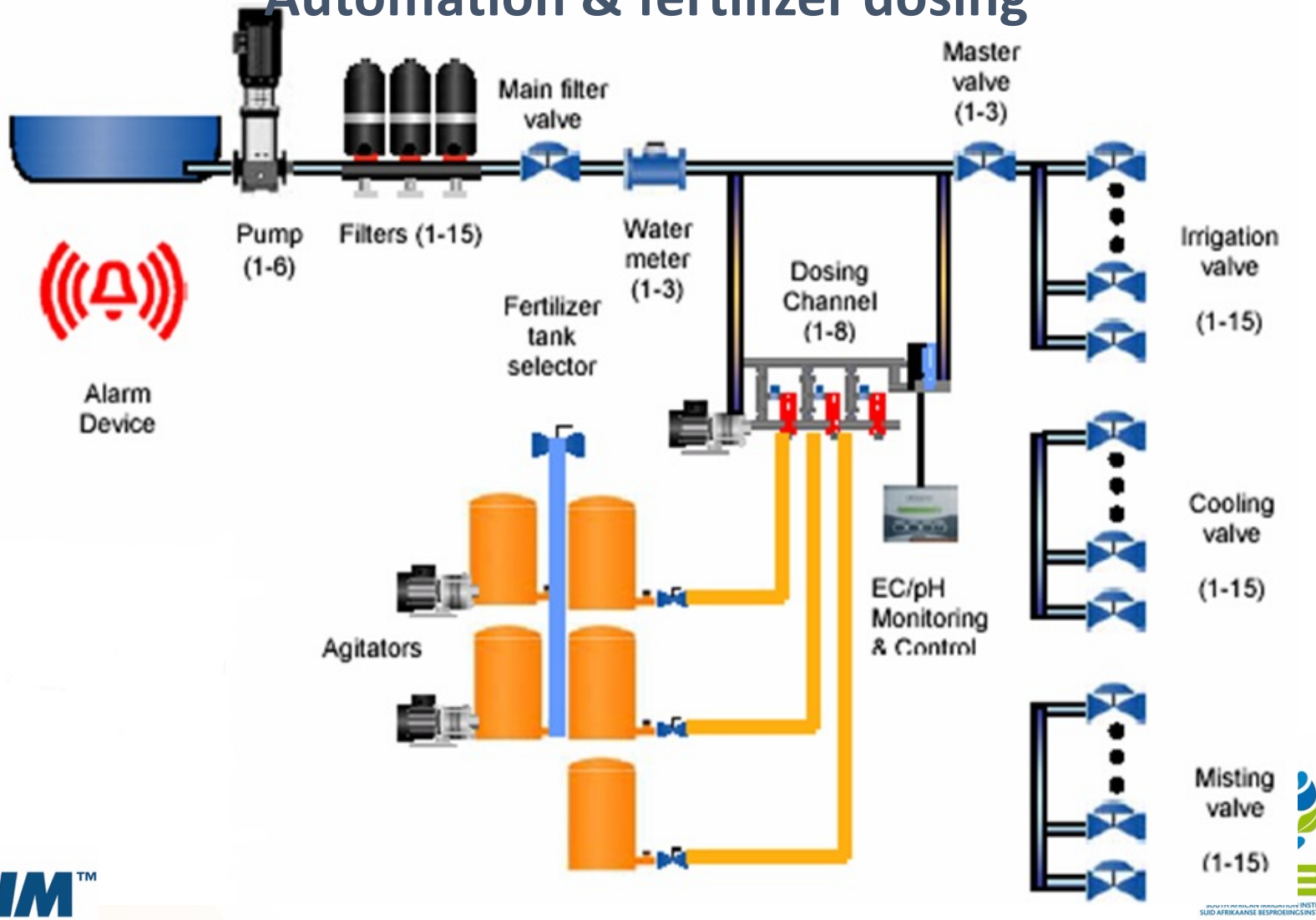
# Automation & fertilizer dosing

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# Fertilizer dosing

# Evaluation of irrigation systems

## Distribution uniformity

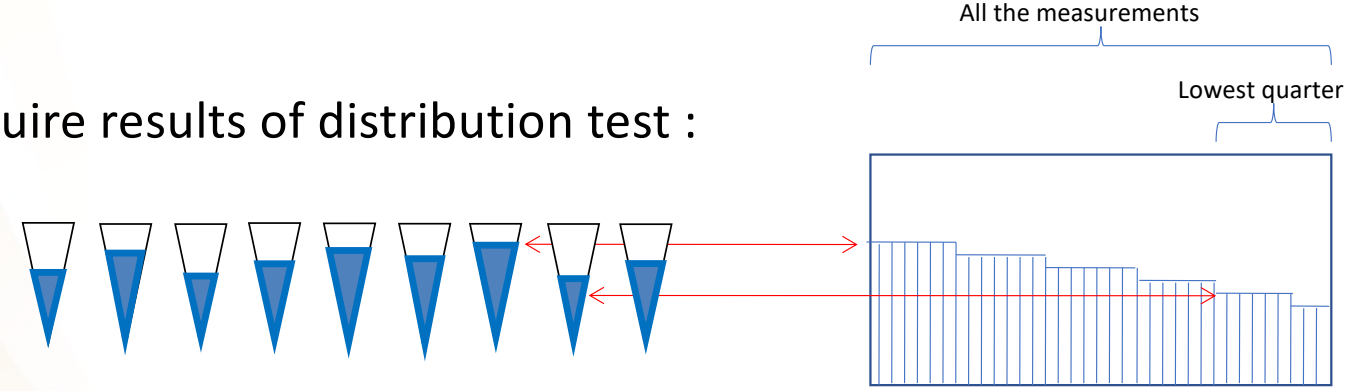
# Evaluation of irrigation systems

## Distribution uniformity

# Measurement of the distribution uniformity

"Distribution uniformity (DU)" = $\frac{\text{Average of lowest quarter of measurements}}{\text{Average of all measurements}} \times 100$

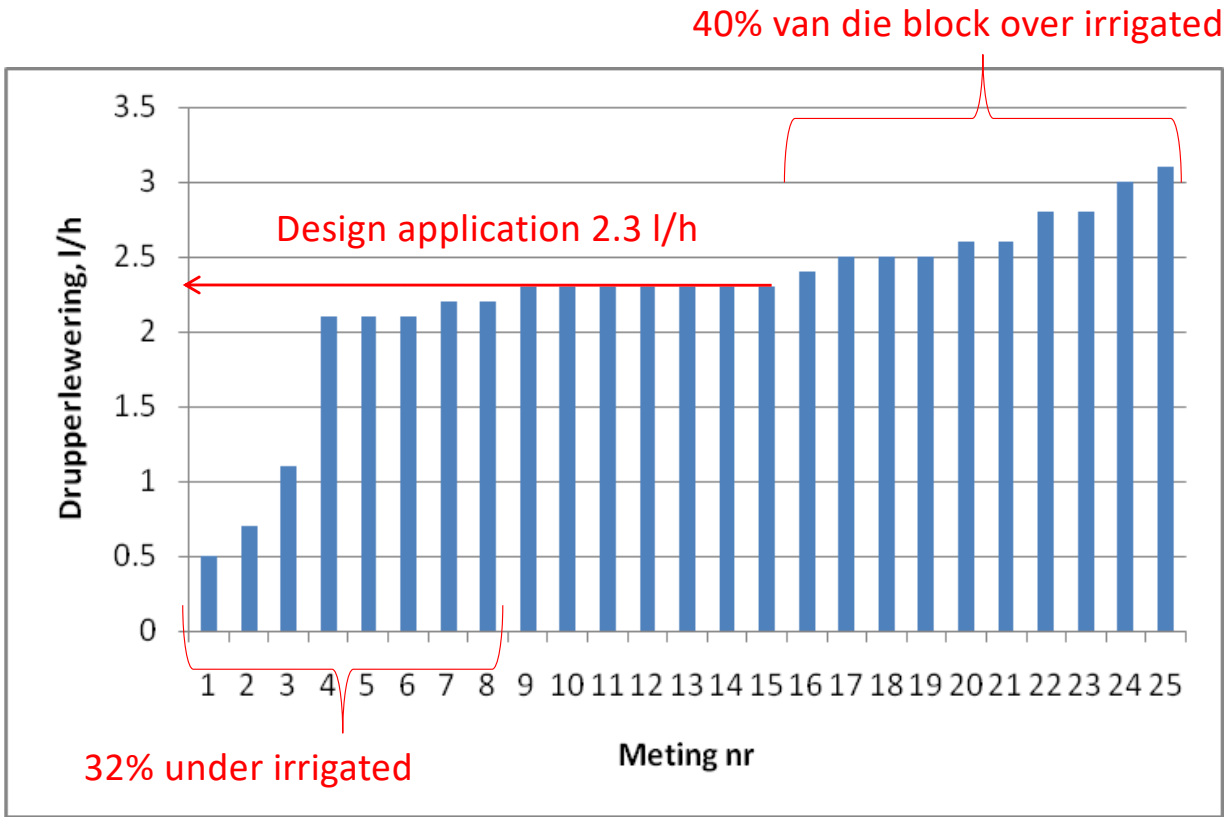
Acquire results of distribution test :




Sort from small to big, example
36 rain gauges → quarter = 9

Burt & Styles, ITRC, 1999

# Distribution uniformity example




Application of 25 drippers in a block measured
Average of all the measurements was 2.2 l/h

# *Micro-jet*

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# Drip


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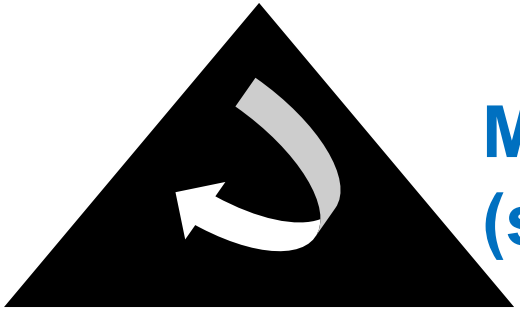
# Monitoring equipment

- Many scheduling devices available
- Vary in approach, complexity
- Based on Soil/ Medium, Plant or Atmosphere

**Predict (model)**

**Assess**
**(observe plant / soil)**



**Measure**
**(scheduling tool)**

# Irrigation Scheduling

*"What gets measured, improves."*

*"Om te meet, is om te weet."*

# Irrigation Monitoring

Crop Systems
Optimising resources for sustainable agriculture

# Continuous Monitoring

- Faster reaction time to change.
- Monitor hourly changes in the soil moisture and average temps directly from the root zone.

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# DrainVision Floor-Scale

**BERRIES** soft fruits / **MJ** Cannabis / **LEAFY VEGETABLES & SPICES** / **NURSERIES**

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# Point measurements


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Meter from Bluelab®.
Enhanced plant-health
in the palm of your hand
FREE Bluelab Pulse™
App for Android 5.1+
with Bluetooth 4.0+
iOS 12.1+ (iPhone Only)
pulse
nutrient
moisture