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MEASUREMENT OF THE DIRTINESS OF IRRIGATION WATER FOR MICRO IRRIGATION FILTERS

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OVERVIEW

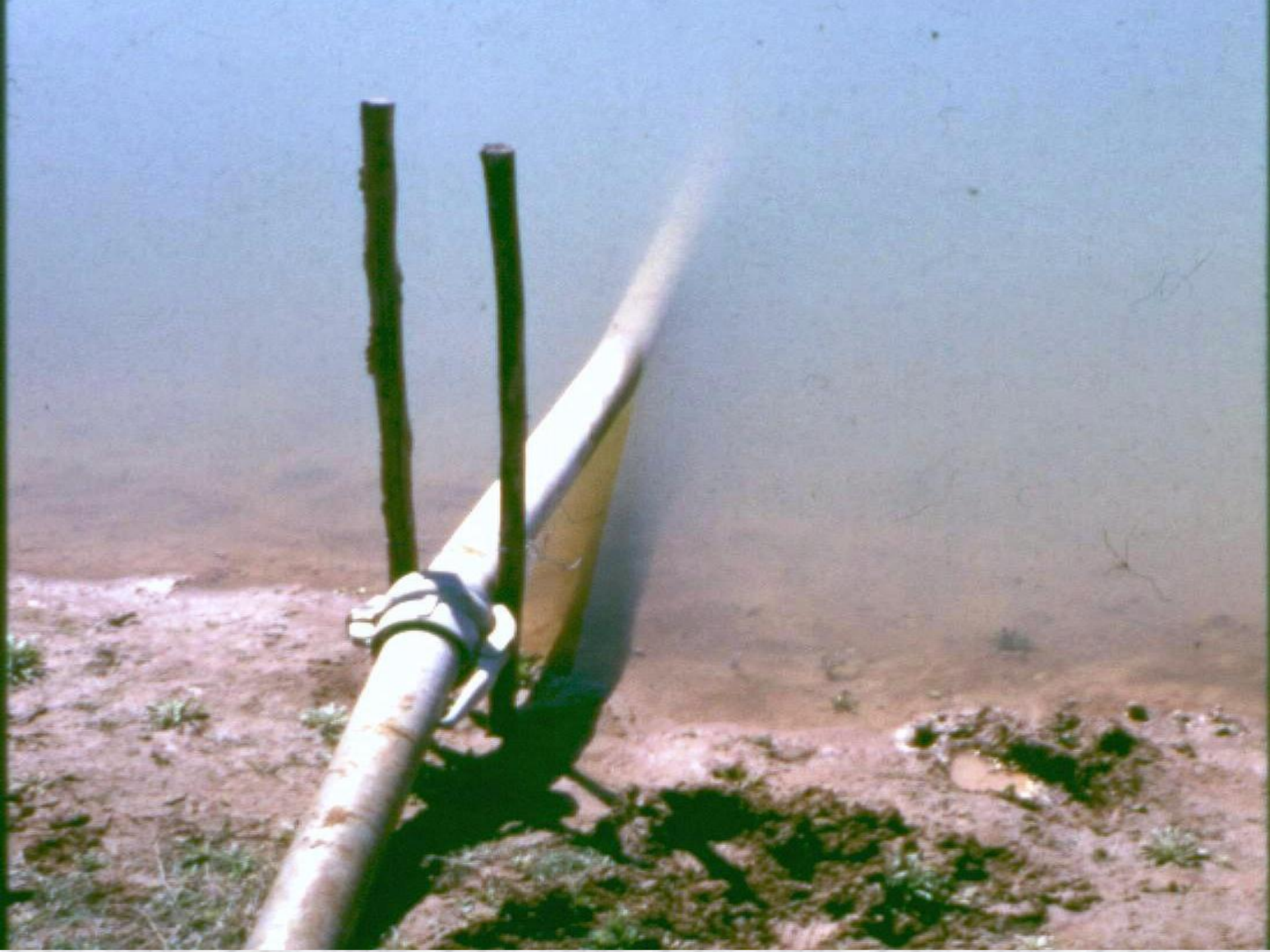
- Hypothesis
- History
- Development of Dirtiness Index Meter (DIM)
- Theory behind the DIM
- Application in practice of the DIM
- Conclusion

HYPOTHESIS

- **Domestic filtration vs Filtration for irrigation:**
  - **Complete removal of dirt**
  - **Partial removal of dirt**

FILTRATION

DOMESTIC



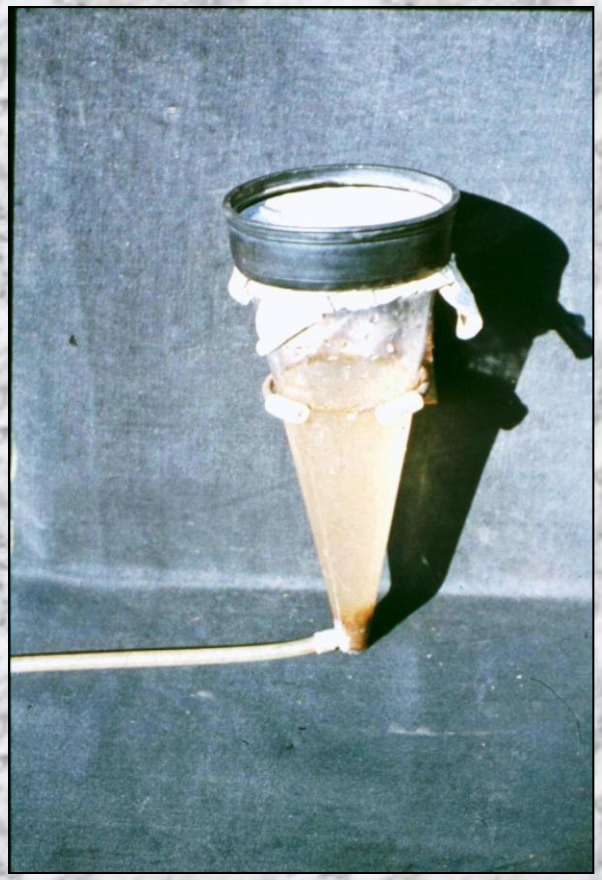
HYPOTHESIS

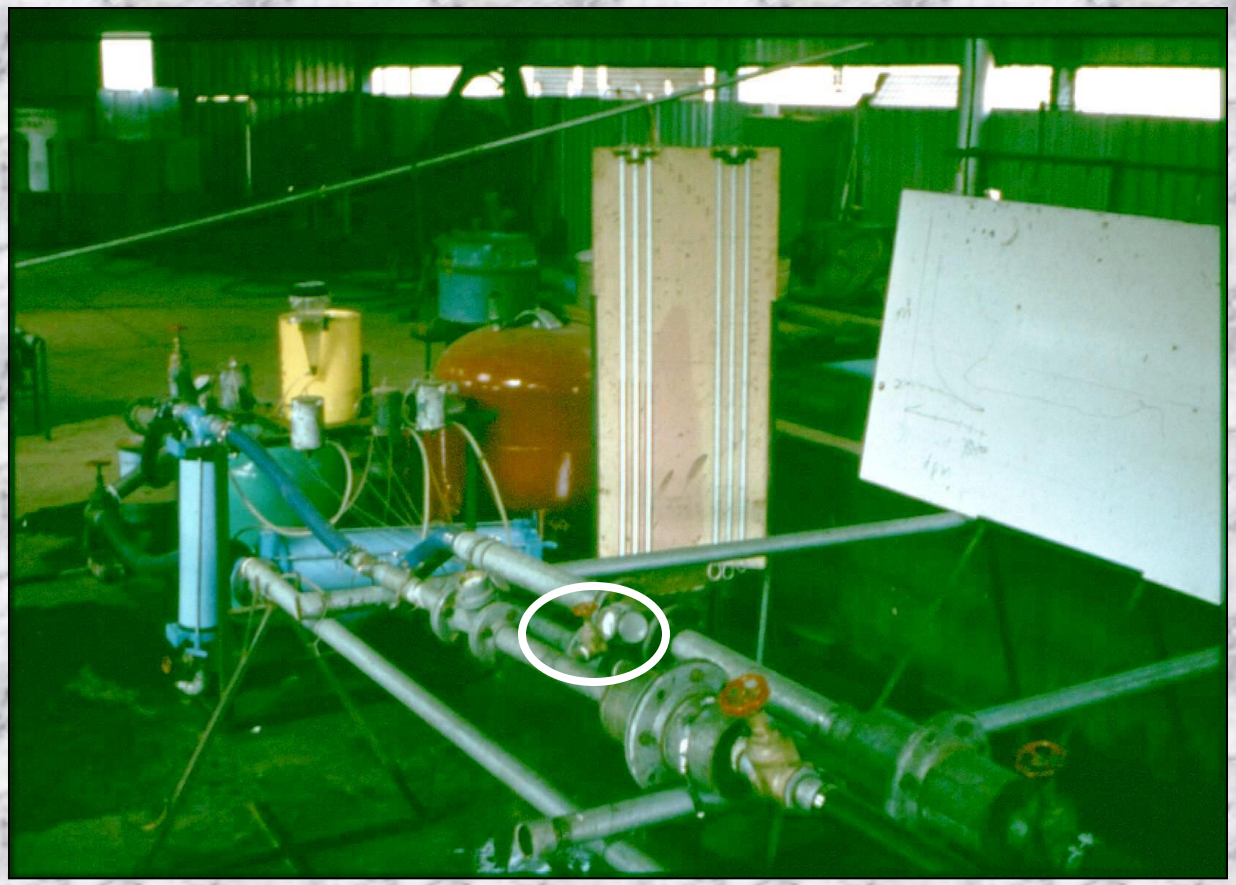
– No removal of dirt:

HYPOTHESIS

– Partial removal of dirt:

HISTORY





DEVELOPMENT OF THE DIM

The prerequisites that were set for a dirtiness meter were as follows:

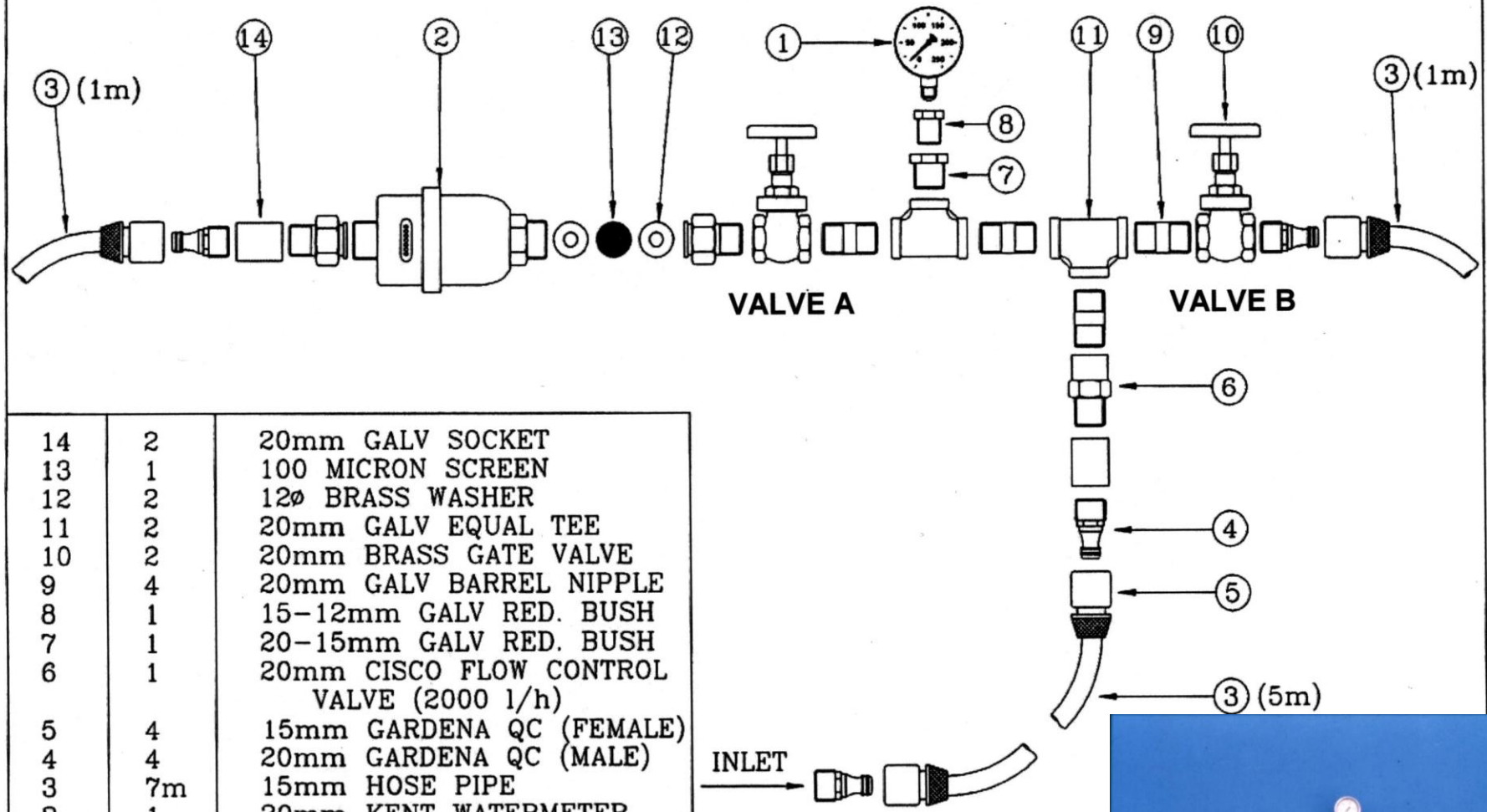
- **It should produce an increasing value for the dirtiness of the water when the dirtiness of the water increases.**
- **It should be capable of repeatable measurements.**

DEVELOPMENT OF THE DIM

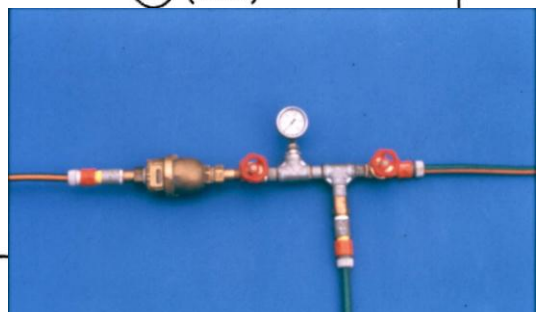
The prerequisites that were set for a dirtiness meter were as follows (cont.):

- It should be capable of repeatable ...
- It should consider the fineness of the filter's element and still give about the same dirtiness value for the same water.
- It should be as fast, simple and cheap as possible.

THE DIRTINESS INDEX METER



NO.	QTY.	DESCRIPTION
14	2	20mm GALV SOCKET
13	1	100 MICRON SCREEN
12	2	12ø BRASS WASHER
11	2	20mm GALV EQUAL TEE
10	2	20mm BRASS GATE VALVE
9	4	20mm GALV BARREL NIPPLE
8	1	15-12mm GALV RED. BUSH
7	1	20-15mm GALV RED. BUSH
6	1	20mm CISCO FLOW CONTROL VALVE (2000 l/h)
5	4	15mm GARDENA QC (FEMALE)
4	4	20mm GARDENA QC (MALE)
3	7m	15mm HOSE PIPE
2	1	20mm KENT WATERMETER
1	1	250kPa PRESSURE GAUGE



THEORY BEHIND THE DIM

There were two problems with the small screen:

- **The more dirty the water, the smaller the volume of water that clogs the screen.**
- **A 300 µm screen filters about ten times more water than a 100 µm screen before it gets clogged.**

THEORY BEHIND THE DIM

Fortunately two solutions could be found:

- **Take the inverse of the number of litres that clogs the screen, so when the number of litres is small, the inverse becomes big and visa versa.**
- **Build a factor into the dirtiness index formula that can compensate for the variation in the volume of each screen.**

THEORY BEHIND THE DIM

From the last two solutions equations (1) and (2) were empirically derived for the dirtiness index (DI) of the water:

$$DI = \frac{1}{L} \times F \qquad (1)$$

Legend: DI = Dirtiness index.

L = Number of litres.

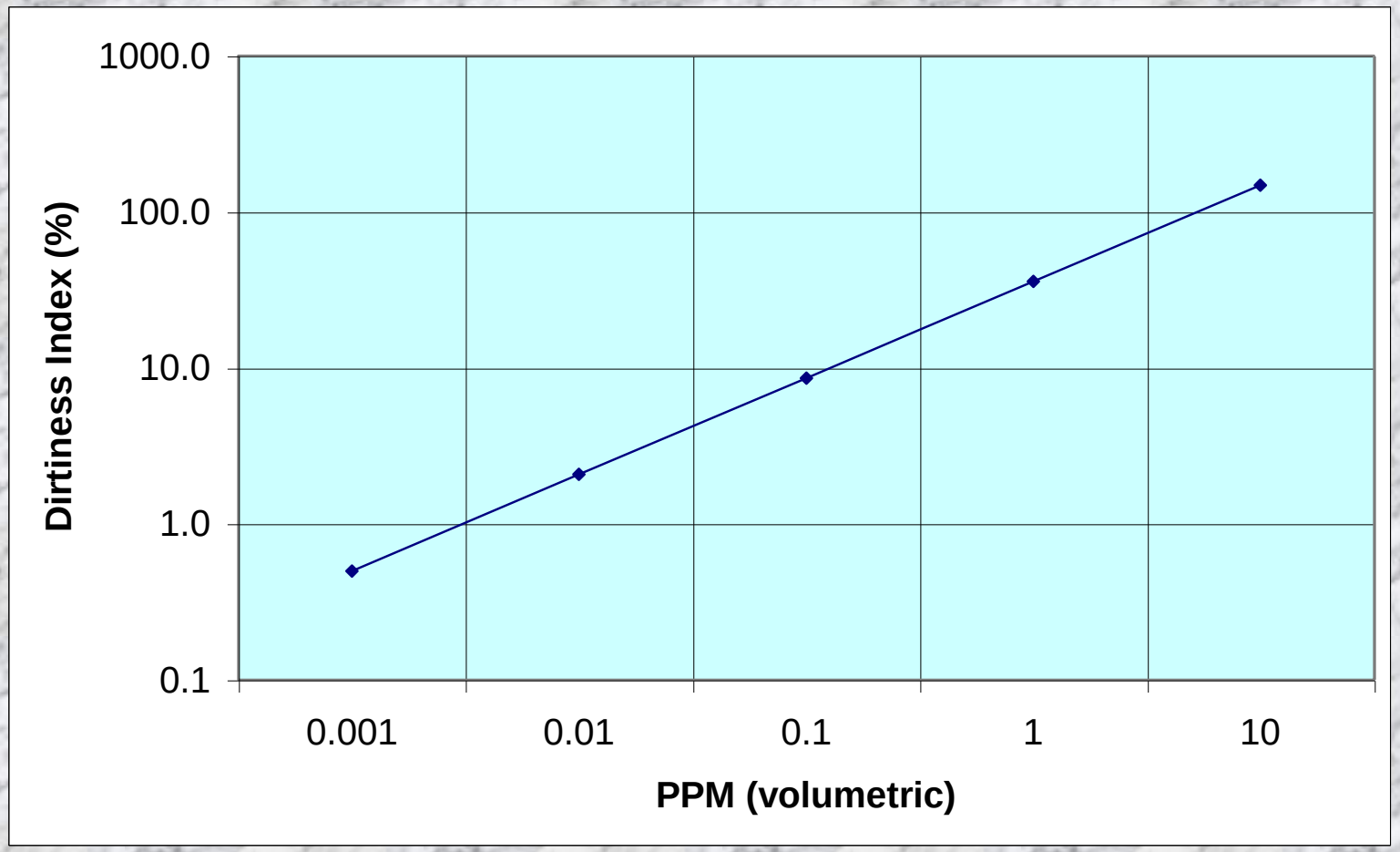
F = Screen factor.

THEORY BEHIND THE DIM

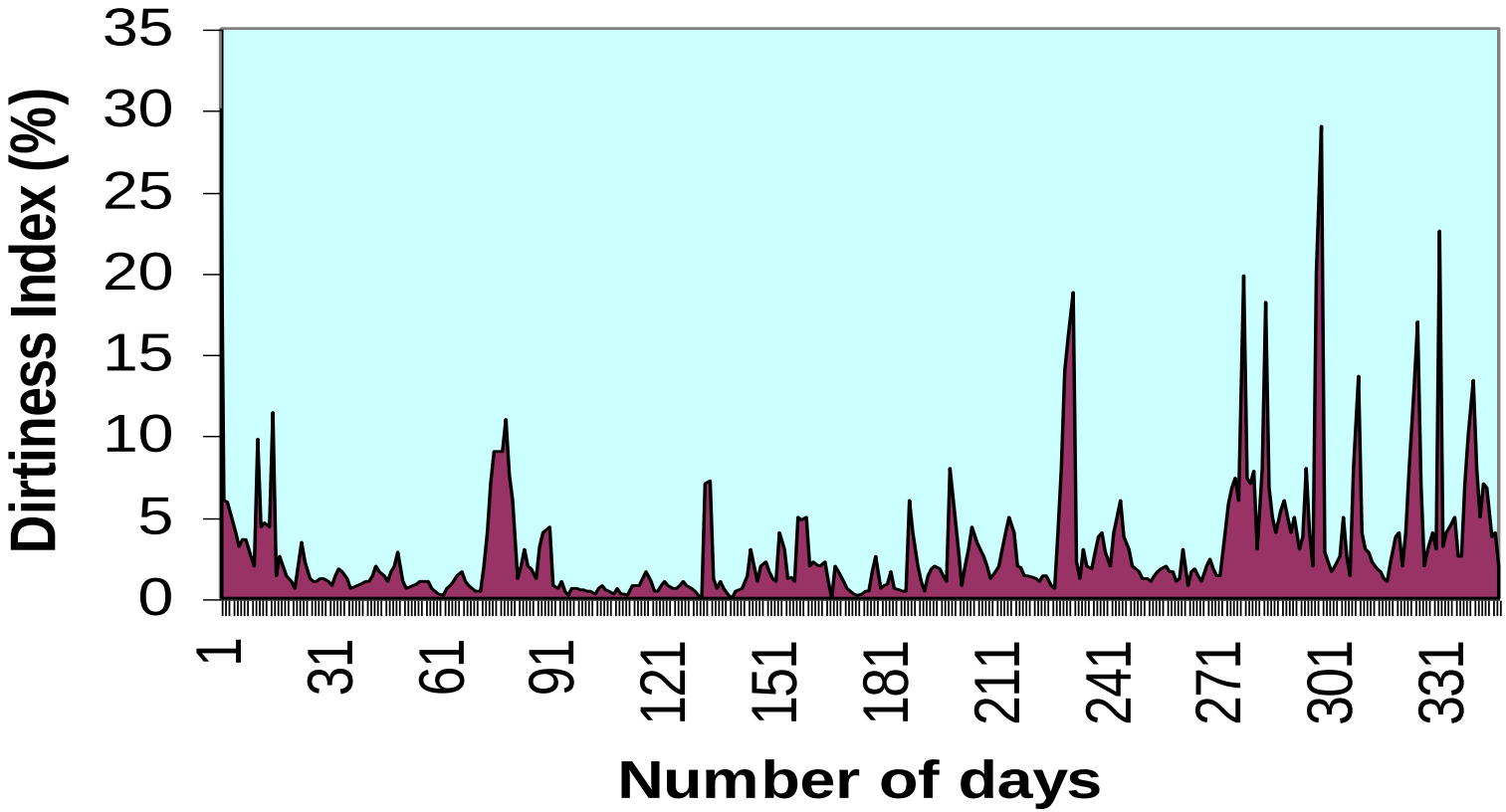
Fineness of screen (micron)	Screen factor (F)*
50	23
100	100
200	430
300	1000

*$F = 0{,}00632 \times (\text{micron})^{2,1}$ (2)

THEORY BEHIND THE DIM



THE DIM IN PRACTICE



THE DIM IN PRACTICE

The filtration efficiency of the filter is defined by equation (3):

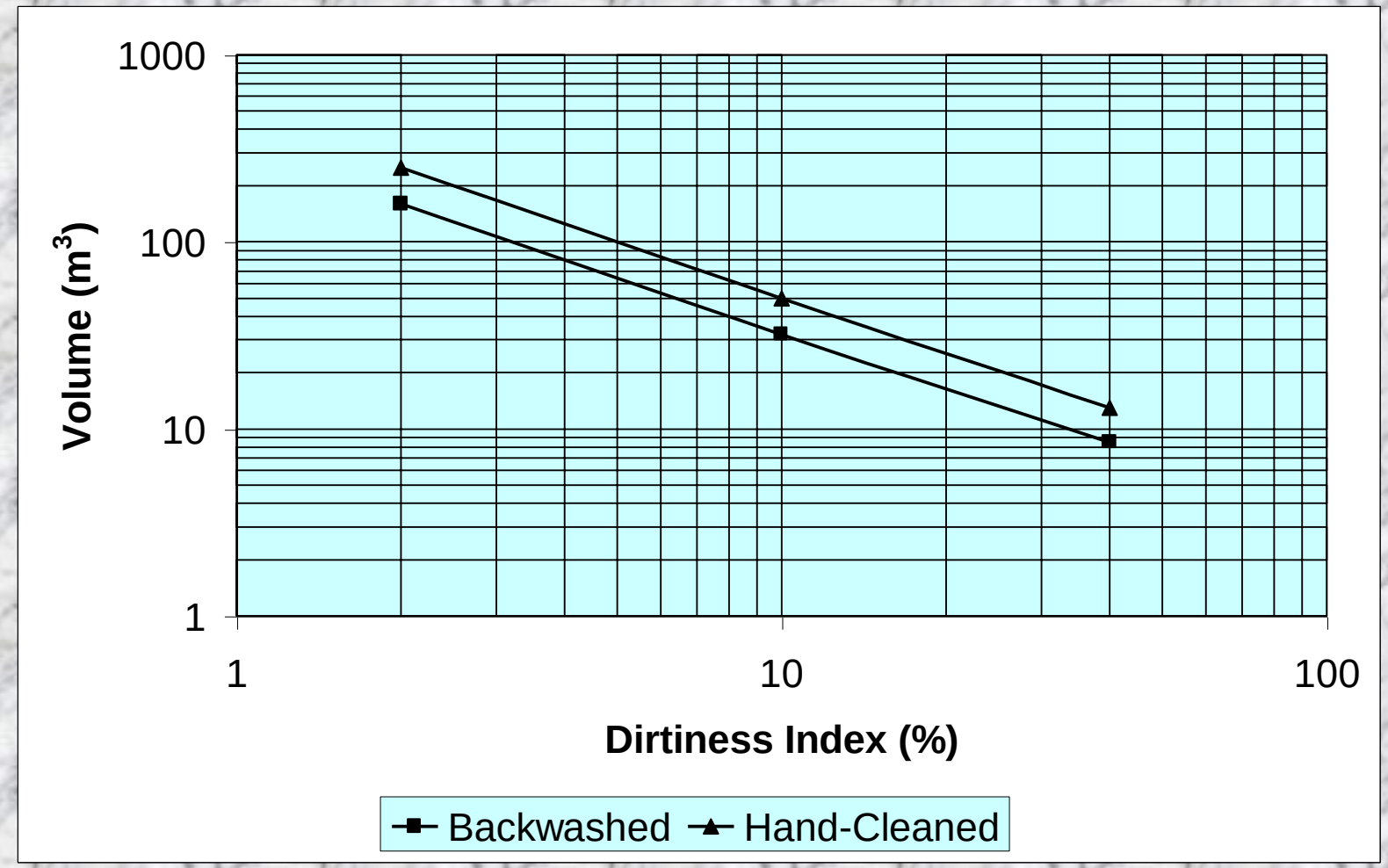
$$\text{Filtr. eff.} = \left(1 - \frac{\text{DI outgoing water}}{\text{DI incoming water}}\right) \times 100 \qquad (3)$$

THE DIM IN PRACTICE

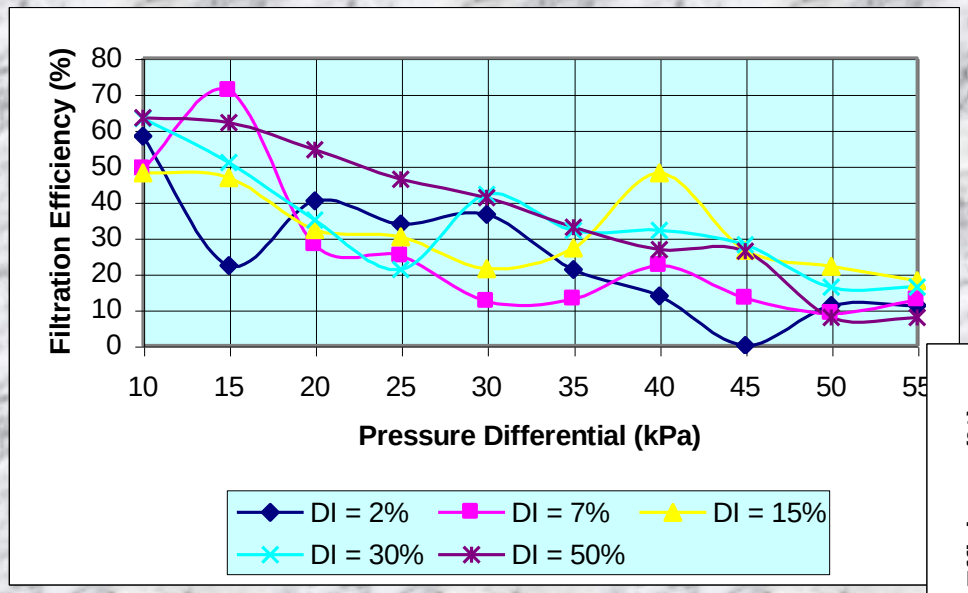
The backwash efficiency of the filter is defined by equation (4):

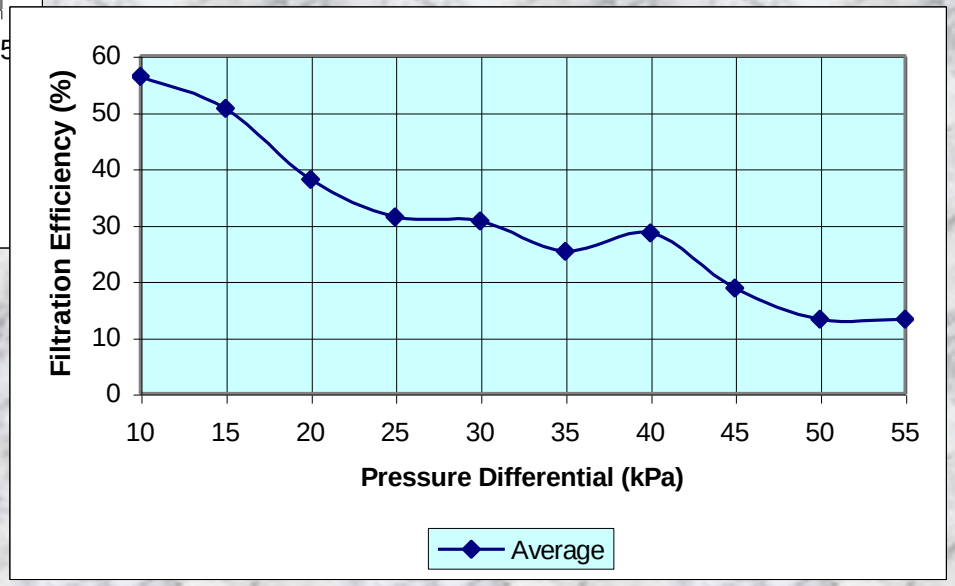
$$\text{Backw. eff.} = \frac{\text{Vol. backwashing}}{\text{Vol. hand-cleaning}} \times 100 \qquad (4)$$

THE DIM IN PRACTICE



THE DIM IN PRACTICE





THE DIM IN PRACTICE

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CONCLUSION

The ARC-Institute for Agricultural Engineering has succeeded in developing a measuring device and method for measuring the dirtiness index of irrigation water for micro irrigation filters. The instrument that was developed is called the Dirtiness Index Meter (DIM) and it has proved to be the ultimate solution for this purpose and it has fulfilled all the prerequisites that were set for it.

The DIM has enabled ILI to do filtration and backwash efficiency tests on micro irrigation filters, making us the only test station in the world that can perform these tests.