Drip Irrigation Management in Large Sugarcane Plots

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1st International Drip-Irrigation Sugarcane Conference

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Distribution of Systems

- Water supply systems to the field
- Main fertilizer and filtration systems
- Valves and secondary filter systems to the end units in the field
- Lateral ends sub-mains
Factors Influencing System Maintenance

- Water quality
- Quantities of water and fertilizer applied to the crop over 12 months
- Quantity of rainfall and its distribution throughout the year
- Trained technical staff and the cost of employing temporary workers
- Age of the drip irrigation system
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Drip Laterals Maintenance

- Lateral flushing
- Protecting against roots intruding and clogging drippers
- Protecting against soil pests
- Protecting against mechanical damage
Pumping System Maintenance

- During the irrigation system the head control operates between 50–170 hectares – to maintain the filtration and fertilization system requires about 10 hours every day

- The water and fertilizer control system requires four hours weekly for maintenance

- The solenoid and valves system requires four monthly hours monthly for maintenance
Head Control Maintenance

Requirements:

- 456 work days a year for daily maintenance
- 26 work days a year for weekly maintenance
- 6 work days a year for monthly maintenance
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Lateral Flushing

The number of laterals flushed depends on the length of the lateral:

- There are 5500 meters of laterals per hectare
- If the lateral is 200 m long there are 28 laterals
- If the lateral is 250 m long there are 22 lateral ends
- If there lateral is 300 m long there are 18 laterals

When laterals are flushed twice a year:

- 10 laterals require 15 minutes work
- One hectare requires 30 minutes of flushing
- For a head control of 170 hectares, 11 work days a year will be needed
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Lateral Flushing

- Flushing the single lateral gives a better result than flushing via the manifold
- The frequency of lateral flushing will be determined by the water quality, and breakdowns during irrigation
- If a sub-main pipe bursts, it is necessary to flush the laterals after it has been repaired
- Before flushing the laterals, it is necessary to flush the sub-main pipes
Fertilizer System

- All fertilizer tanks must be flushed before refilling
- The filtration filters must be cleaned every day that they are used
- All solenoids must be checked every month and replaced as needed
- Every week it is necessary to check that the quantity of fertilizer remaining in the tank is consistent with the quantity of fertilizer that was supposed to be applied in the plot.
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Control Filters in the Field

- With manual flushing the cleaning rate of the filter depends on the water quality.

- When water quality is good, and the filter does not become clogged every 10 irrigation applications, it is necessary to check that there is no problem with the screen / disc filter.

- When water quality is poor or where there is a large quantity of organic material clogging the discs/ screens, it is necessary to have a double system and soak the dirty discs in a tank with chlorine until the next irrigation.
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Fertilizer Filtration Systems

- The root system in sugarcane is superficial, so that soil cannot accumulate water for the plant for any extended period.
- If irrigation and fertilization are stopped due to a technical problem, this will damage the yield.
- Therefore, it is necessary to maintain spare parts for all system components.
Experiments and Trends

In Sugarcane Crops for 2011 - 2015

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Design calculation:

All the designs and estimated figures in this proposal are based on the following calculation assumptions:

- Nursery production design capacity
  - Number of production months per year: 10
  - Total number of growing days per year: 300
  - Propagation period per cycle: 4 weeks
  - Working days per propagation cycle: 6 weekdays
  - Working days per month: 24
  - Total number of growing days per year: 240
  - Plants per 1 Ha sugar cane: 50,000
  - Total growing area per production facility (Ha): 4,000
  - Growing period (from planting to harvest): 12 months
  - Total area per year to be re-plant (10% of total area): 400 Ha
  - Total supply plants per year: 20,000,000
  - Average rooting success in nursery: 80%
  - Number of Eyes to be set annually: 25,000,000
  - Eyes to be set per day: 104,166
  - Eyes for 4 weeks cycle: 2,500,000
  - Number of trays (5*9) required per day for plant production: 2,315
SUGAR CANE NURSERY CONCEPT

- Tissue cultures
- Hardening
- Planting in field nursery
- Eyes production

Cultivation nursery
SEMI-AUTOMATIC PLANTING
Sugarcane experiments
2005 – 2010

- Brasil – 5 experiments
- Honduras
- Argentina
- Tanzania
- India – 3 experiments

- Total scope: over $100,000
In 2011 – 2012

- Additional experiments will begin in:
  - South Africa (Simunye)
  - Mauritius
  - Peru
Control Methods

- Water levels
- Fertilizer quantities
- Plant’s growth rate
- Yield forecast
A LYSIMETER IN A SUGAR CANE FIELD
WHY USE A WEIGHING LYSIMETER?

- Weighing the lysimeter and the drainage.
- Knowledge of the irrigation efficiency.
- Control of growth.
Use of Drip Irrigation Systems

- To conduct all the sugarcane plant’s requirements through the drip lateral to the plant’s root system
The Rhizosphere

The region of soil immediately around the roots

Has large numbers of harmless bacteria and fungi living on nutrients excreted from the roots
Nitrogen Fixing Bacteria

* Free living Nitrogen Fixation

nitrogen-fixing bacteria include cyanobacteria and soil bacteria in the genera *Azotobacter* and *Clostridium.* Contribute to the nitrogen budget in the soil but not as important in agricultural soils as symbiotic nitrogen fixers

*Azotobacter vinelandii* is an aerobic soil-dwelling organism with a wide variety of metabolic capabilities which include the ability to fix atmospheric nitrogen by converting it to ammonia.
Nitrogen Fixing Bacteria

*Symbiotic Nitrogen Fixation

Most important bacteria are members of the genus Rhizobium and Bradyrhizobium, that fix nitrogen in association with leguminous plants (clover, alfalfa, peas, soybeans).
Microorganisms and Agriculture

* Agro-ecosystem health, including biodiversity, biological cycles and soil biological activity

* Naturally control the right combination of nutrient availability and uptake

* Natural Plant protection: control pests and diseases, induction of resistance to disease
Use of Mycorrhiza

- Strengthens the plant’s roots
- Reduces water quantities
- Saves on fertilizers (phosphor)
Fungal Insecticides

Fungi create natural epidemics among insect populations, often killing a high percentage of the population.

Only a few fungal insecticides are currently available in the US.
Pest & Disease Disinfestation

- Use of organic materials and viruses to enhance the plant’s immune system
- Use of pesticides that do not pollute the soil
- Reduce the use of spraying – using tanks and airplanes – and conserve energy
Solution for Root Development

- Add growth accelerators to the root zone
- Extra
Organic Solution for Fertilization

- Use by-products that were created during the sugar and ethanol production process (Vinasse)
- Bacteria
- Organic fertilizers are less expensive than regular fertilizers
High Production Sugarcane

Drip irrigation provides directly to the plant's roots.
Thank you

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