Department of Agricultural,
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Session 3: PAE inspection harmonised test methods for PAE not included in ISO EN 16122

8th European Workshop on Standardised Procedure for the Inspection of Sprayers in Europe (SPISE)

Proposal of a methodology for the functional inspection of a fixed spray delivery system

SPISE TWG 24

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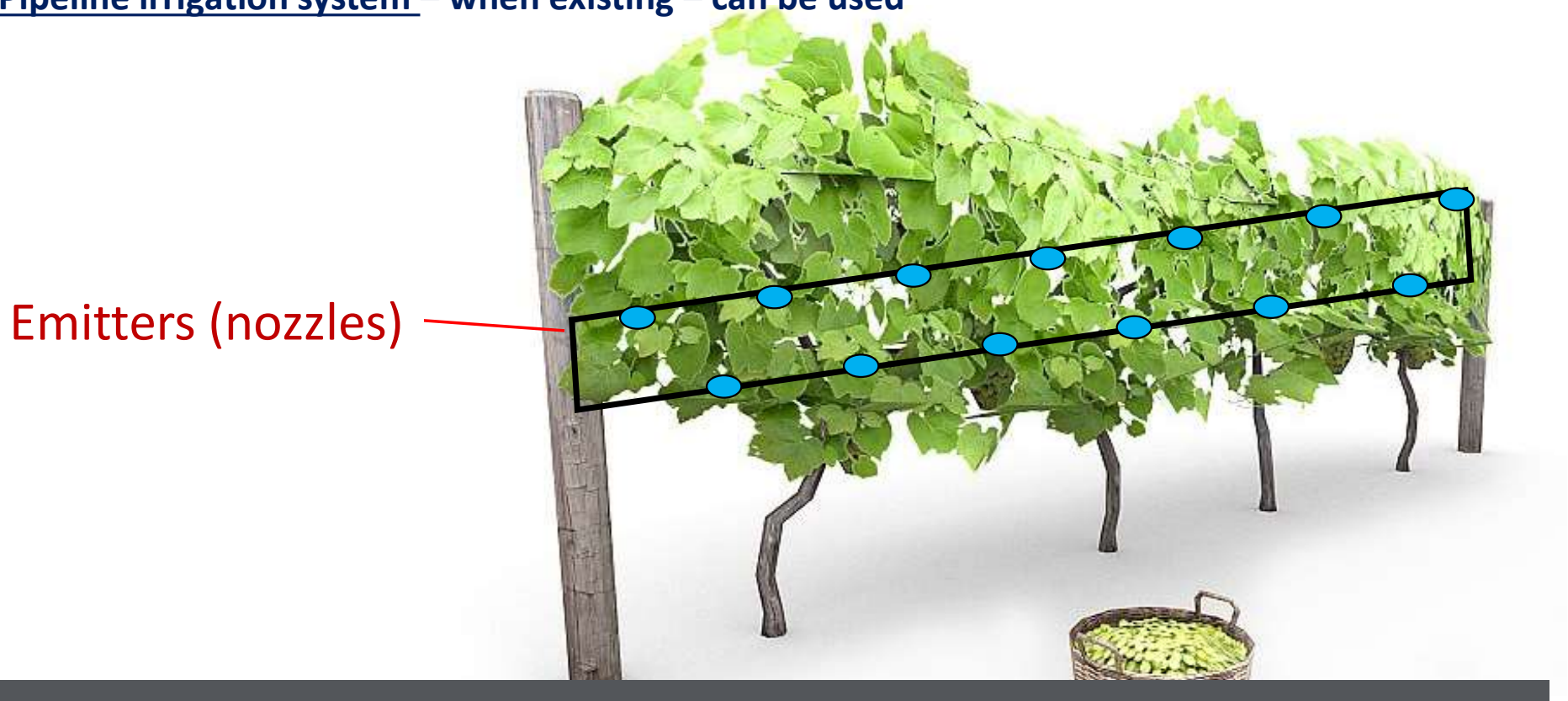
FIXED SPRAY APPLICATION METHOD

Consists of a network of emitters (nozzles) and spray lines preinstalled in the crop canopy/trellis and connected to a pumping station and a cleaning system

<u>Pipeline irrigation system</u> – when existing – can be used



FIXED PESTICIDE APPLICATION EQUIPMENT DEFINITION

Fixed spray application is defined by using different names:

- **Solid Set Canopy Delivery System (SSCDS)**
- **Permanent Spray System (PSS)**
- **Fixed Spray System (FSS)**
- **Fixed Spray Delivery System (FSDS)**
- **…**

FIXED SPRAY DELIVERY SYSTEM – S.O.P.H.I.A. (e.g.)

FIXED SPRAY DELIVERY SYSTEM – POSSIBLE ADVANTAGES

- To be used also for **protection against frost**
- **Noise reduction** during PPP application
- Potential to **fully automate** PPP application
- Irrigation and/or conditioning system **combined** with PAE
- Possibility to **spray in a very limited time** and also **during critical weather periods** (wet soil)
- Possibility to **spray in difficult land positions** like those of the "Heroic viticulture" (steep slopes)
- **Complementary or alternative to conventional** ground based **sprayers** (either air-assisted sprayers coupled with tractors or knapsack mistblowers)

More than 100 ha of FSDS already installed in Italy; other 200 ha expected within the next 2 years

FIXED SPRAY DELIVERY SYSTEM MAIN COMPONENTS

PUMPING STATION

(fixed or mobile)

CLEANING SYSTEM

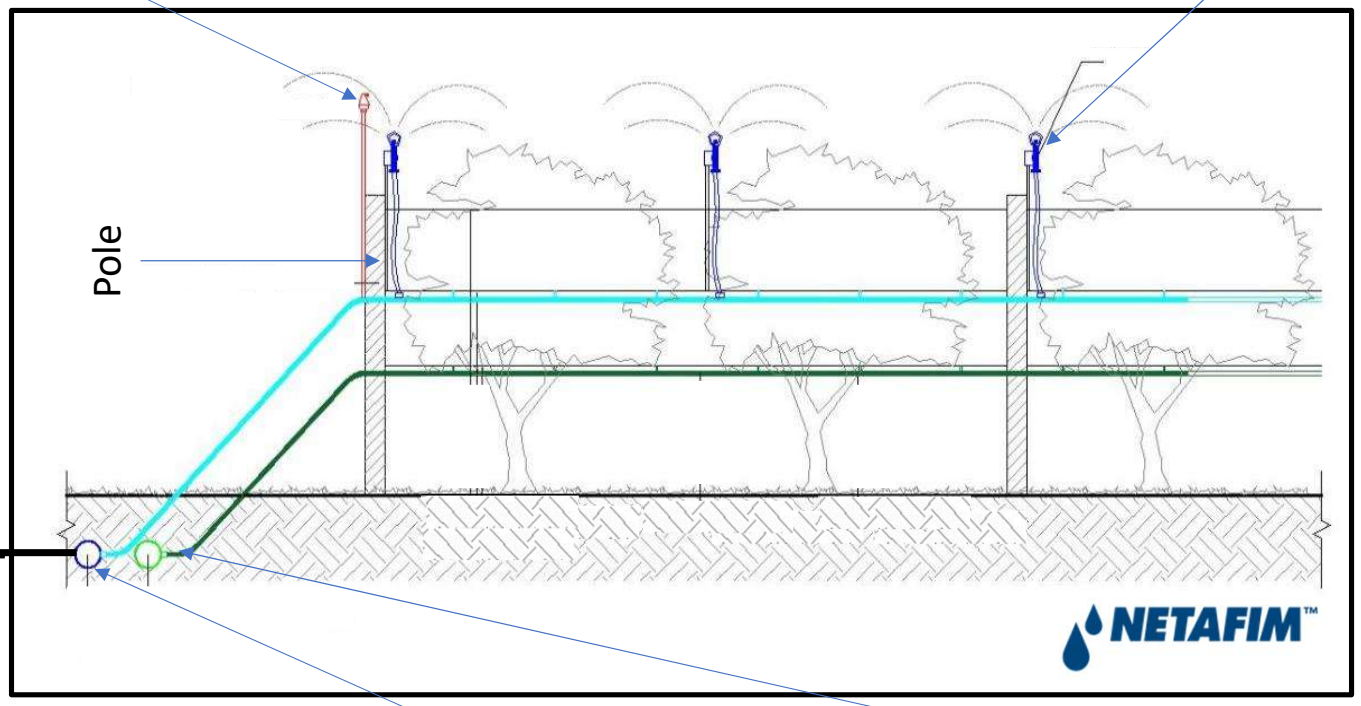
(es: tap or rainwater supplies, air compressed, …)

vent

CANOPY DELIVERY SYSTEM

Emitters

Pole



3-way valve

Fix spray delivery system connection

Drip irrigation system connection

FIXED SPRAY DELIVERY SYSTEM COMPONENTS – PUMPING STATION

FIXED

Spray mixture injected by an autonomous pumping station (e.g. equipped with Dosatron®)

Inspection shall be carried out in field

MOBILE

Spray mixture injected by using a sprayer

Inspection could be carried out at the workshop

FIXED SPRAY DELIVERY SYSTEM COMPONENTS – EMITTERS

They shall:

- **Ensure uniform flow rates along the rows**
- **Avoid dripping after switch-off**
- **Be adequately spaced and oriented along the row in order to match the canopy profile**

FIXED SPRAY DELIVERY SYSTEM – OTHER COMPONENTS

Pressure gauges

(**functional test**)

Pipeline and microtubes

(**visual test**)

Cleaning and tank emptying

(**visual test**)

Flowmeters

(**functional test**)

Filters

(**visual test**)

BEING A PAE, ONE FIXED SPRAY DELIVERY SYSTEM SHALL COMPLY WITH art. 8 SUD

How to inspect this type of PAE:

- In field inspection necessary for fixed components
- At workshop inspection possible for some sprayer components if used to «feed» it

FIXED SPRAY DELIVERY SYSTEM – PRE-INSPECTION

The **pre-inspection refers to all the preliminary operations made by the inspector at the beginning of the inspection process** and mainly consists of visual tests:

- The FSDS (i.e., pumping station and canopy delivery system) **shall be properly cleaned** checking filters and other internal and external components giving special consideration to areas of contamination to which the inspector could be exposed
- **The components and test adapters** used for the inspection **shall work properly**, **not cracked and be equipped with the required protection/safety systems**
- If present, the **moving parts shall work** correctly
- The FSDS **shall not show visible liquid leaks**, excessive abrasions, permanent deformations, cuts, cracks, and/or significant corrosion or damages in general

FIXED SPRAY DELIVERY SYSTEM – INSPECTION OF PUMPING STATION

- **There shall be not liquid leaks**
- **No spraying and dripping on pumping station**

Method of verification – visual test

- Fill the tank and check for eventual leaks (pumping station NOT running) and then with the pumping station running check for eventual leaks

- **Pump capacity**

Method of verification – functional test

- **Backflow for agitation, pulsations**

Method of verification – functional test

- **instrument displays shall be readable from the operator position during spraying**

Method of verification – visual test

FIXED SPRAY DELIVERY SYSTEM – INSPECTION OF PRESSURE GAUGES

- The **pumping station** shall be equipped with a pressure gauge
- The **cleaning system** shall be equipped with a pressure gauge
- The **canopy delivery system** shall be equipped with a minimum of 2 pressure gauges:
  - **One** installed **at the topmost part of the spray line**
  - **Second** installed **at the bottommost part of the spray line**

Method of verification – functional test

- Pressure gauges shall be **tested mounted on their FSDS main components or on a test bench** for comparison with a calibrated test pressure gauge.
- **Measurements** shall be **carried out with both increasing and decreasing pressures**. In each case, the accuracy of the FSDS pressure gauges shall be checked at a minimum of 4 equally spaced points within the relevant working pressure range.

FIXED SPRAY DELIVERY SYSTEM – INSPECTION OF EMITTERS AND ANTI-DRIP DEVICE

- After being switched off there **shall be no continuous dripping** from nozzles 5 s after the spray jet has collapsed
- **Emitters shall be provided with an anti-drip device**
- **spray pattern shall match**, as much as possible, **the canopy area/crop** to cover
- **spacing and their orientation** shall **be uniform** along the spraying lines
- **flow rate** shall be **accurate**

Method of verification – visual and functional test

- Emitters spray patterns shall **uniformely match the canopy** along the row
- The **average flow rate of at least three emitters** (nozzles) per row shall be measured with a measuring device (e.g., cylinder) to calculate the average value of a single emitter
- Nozzle **flow rate shall not exceed ±15 % of the nominal flow rate** indicated by the nozzle manufacturer for the maximum working pressure of the FSDS instruction handbook

FIXED SPRAY DELIVERY SYSTEM – ASSESSMENT OF PRESSURE DROPS

- The **pressure drop between the top- and bottommost part of the canopy delivery system**, while spraying, shall **not be higher than ± 10 % (??)**
- The **canopy delivery system** shall be **equipped with one or more vents** based on the layout design

Method of verification – visual and functional test

- Test shall be carried out using the working pressure given by the manufacturer
- Use two pressure gauges with adequate accuracy as testing material. Pressure gauges shall be installed on the top and bottommost parts of the canopy delivery system
- Measure and report the values given by the two pressure gauges

FIXED SPRAY DELIVERY SYSTEM – INSPECTION TEST REPORT

The test report shall list the following minimum information:

- **Place** of execution of the tests (field where the FSDS is installed and test station)
- **Name, contact details, and company name** of the inspector who carried out the inspection and, where different, of the company providing the service (testing organization) and **date of the inspection**
- **Details of the owner** of the FSDS (name, address, etc…)
- **FSDS manufacturer, serial number, year of construction**, and other identifications per each main component;
- **Type of FSDS** (mobile, with mobile pumping station. Conversely, it can be defined as fixed)
- Any **malfunction** of the FSDS (even if the malfunction is a result of the FSDS design) and also those useful to identify the corrective actions work required
- **Result of the periodical mandatory inspection** (results of all inspections performed, both visual and functional)

National or local regulations may give additional requirements for reporting inspections

INSPECTION OF FIXED SPRAY DELIVERY SYSTEM – NEXT STEPS

- Need to define the **number of emitters** (nozzles) **to be controlled** (usually their number is from 700 - 1000 per ha of surface (10.000 m^2) : Suggestion to control only one for each row (pipeline) chosen randomly (??)
- To **limit and simplify** as much as possible **the periodical inspections** in order **to reduce the cost**. **Inspectors have to move to the fields at which the FSDS are installed.**
- **Verify in practice** the proposed FSDS **inspection methodology**
- Identify the **timing required to inspect** each component

  E.g.:

  - Pumping station – between 30-45 minutes
  - Pressure gauge – between 5-10 min each
  - Emitters flow rate – between 3-5 min each
  - Pressure drop – between 4-6 min each sampling point
  - We have to consider that the inspector shall move in field to inspect each component (> time with respect to workshop)

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Thanks for your attention