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RESEARCH ON DILUTED SEWAGE FERTIGATION

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Abstract: *The technical problem to be solved solution consists of applying a controlled manner, wastewater diluted depending on the specific crop and avoiding environmental pollution. The technical solution consists of an installation of irrigation and hose drum A, which distributes the wastewater with a ramp and some hoses equipped with a water source B, which can be a mobile pumping aggregate absorbing water area front / ground water or be a hydrant posed on a network of pipes under pressure, a trailer tank C, carrying manure from a treatment plant / mechanical separator plant of irrigation, a pump D, which absorbs manure in tanks and they injected into the irrigation system, and a monitoring device is that the flow of water and slurry counting, the pressure in the drum, the pump and the ramp, the concentration of salts, fertilizers and pH of the solution tachometer for measuring velocity / the watering.*

Keywords*: irrigation; wastewater; micro-sprinkler; fertigation*

1. Introduction

Wastewater is an important source of water and nutrients and can come from agribusiness livestock complexes, urban, rural or industrial. In order to be used in irrigation, wastewater quality should correspond to no risk of environmental pollution. This is done by sewage plants in various ways to separate components that can contribute to environmental pollution and nutrient content is not altered. Research conducted so far have pursued harnessing wastewater concentrated or least diluted, administered outside the growing season of plants, washing plants. In wet condition when is used diluted wastewater, sewage water mixture watering done in specially designed ponds and pumped that were to be distributed to plants in concentrated form.

2. Description of the installation

An example of embodiment of the solution in connection with figures 1-5, which represent: Figure 1, scheme of the installation; Figure 2 is a front view of the ramp; Figure 3 is a side view of the ramp; Figure 4 is a top view of the ramp; Figure 5 details the distribution nozzle.
Technical solution consists of an irrigation installation drum and hose A, which distributes the wastewater with a ramp and some hoses equipped with a water source B, which can be an aggregate mobile pumping absorbing surface water or groundwater can be a hydrant pipeline network posed a pressurized tank trailer C, carrying manure from a treatment plant / mechanical separators irrigation system, a pump D, absorbing the slurry tank and injecting them into the irrigation system, and a monitoring device E is that the flow of water and slurry counts, the pressure in the drum, the pump and the ramp, the concentration of salts, pH and tachometer for measuring the speed fertilising / watering rate.

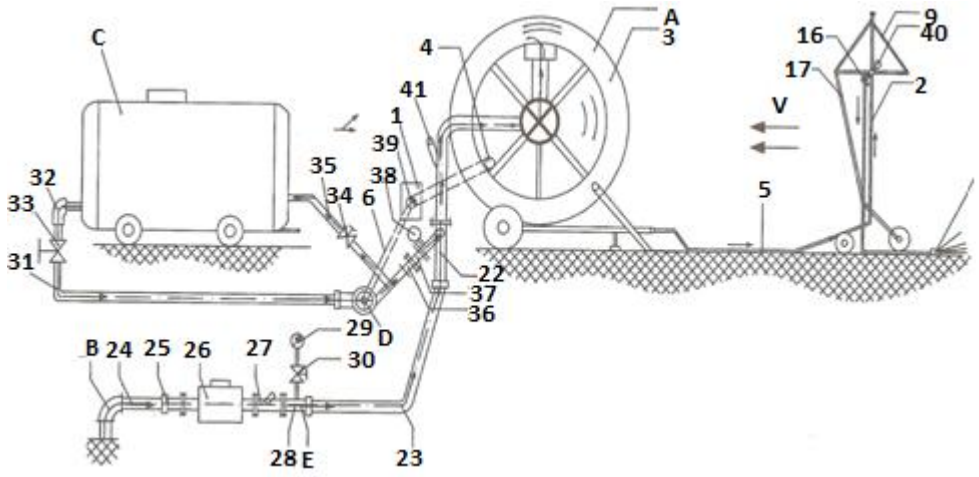

Fig. 1. Schematic layout

Irrigation installation and hose drum A, Figure 1, equipped with a heat engine 1 ramp 2 heat engine which drives a drum 3 by a transmission 4, meaning rolling of hose 5 and haul ramp 2 with a speed v, which is proportional to the watering and the same heat engine operating 1 haul with a transmission 6 a pump D. The watering Ramp- Figure 3.2, is originally equipped with 7 nozzles for watering by micro-sprinkler with clean water, nozzles which are positioned on a side pipe 8, reinforced with some farms 9, Figure 3.3, and anchored to a mast 10, with some cables 11. The ramp is supported on some wheels 12, mounted on a frame 13 side areas and in the centre there is a wheel 14, Figure 3.3, which supports a pipe 15. The pipe 15 is coupled at one end to the polyethylene tube and the other end to the lateral pipes 8, Figure 2, and in the curved region of the pipe is fixed sasi13. For watering the waste water, the nozzles 7 are replaced with stoppers and in diametrical position of the lateral pipe 16 there are fastened some minivalve that connects with one end to the other lateral pipe 8 and provided with a hose connector engages 17 which in its turn has at the other end a nozzle dispensers 18, Figure 3.

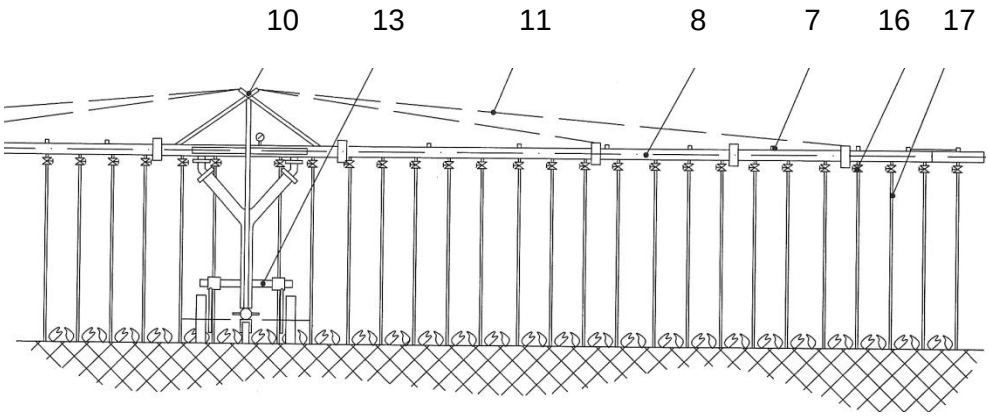

Fig. 2. Front view of the ramp

Distance between nozzle and hose length is chosen according to the scheme of sowing and plant size 19, Figure 4. Also, ramp width L and numbers of piping side are subject to the system and hydraulic parameters existing at the plant. Distributing nozzles 18, figure 5, they are provided with elongated side slots, resulting in a lateral distribution of the fertilizing solution a given width, depending on the pressure and therefore flow rate. Distributors nozzles are calibrated to distribute constant flow rates and positioning of the slots section and wastewater distribution favors low pressure and low risk of clogging.

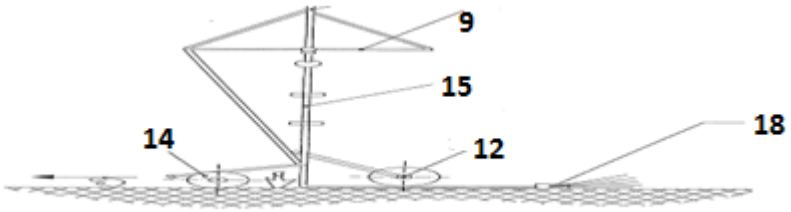

Fig. 3. Side view of the ramp

In operation installation working with two heights to ramp proper watering crops with low side and respectively high side. The other components of the system are known and installation is coupled with a branch system 22, at the pump D and the flexible hose 23, representing the slurry supply circuit and respectively the installation water.

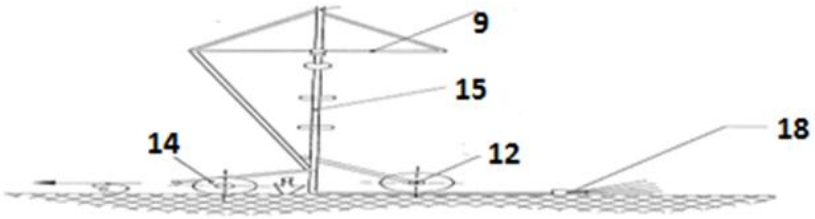

Fig. 4. View from the top of the ramp

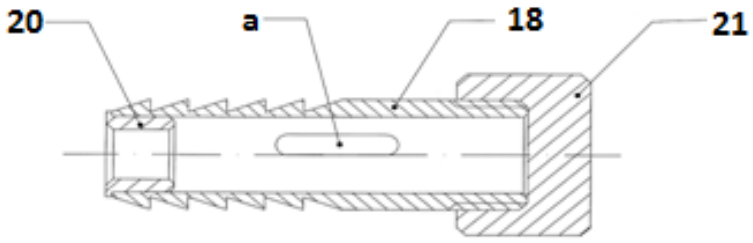

Fig. 5. Detail nozzle distribution

The water source B may be an aggregate of pump who absorbing surface water or ground water or can be a hydrant network posed a pressure pipe which supplies high pressure water irrigation system by a pipeline 24 , Figure 1, and a semitronson 25, coupled to a water meter 26, which in its turn is coupled to a pressure regulator 27 and a minitronson 28, a manometer 29 and a valve 30, which is coupled minitronson and flexible hose 23.
Tank trailers C, transporting manure from the treatment plant / mechanical separator plant of irrigation and working position intake circuit feed 31 of the pump D, through an elbow 32 and a valve 33 and the surplus pump flow in the injection valve is returned to the tank through the branch 34 and 35. The flow of slurry tankers returned contribute to bubbling and mixing manure into the tank and using a non-return valve 36 prevents access water tank when pump is not working.
Pump D, is designed to inject the slurry into the irrigation water under pressure on the input side of the plant, the exact dilution and homogenizing the solution under conditions of turbulence fertilizers and pressure. The injection is carried out through the valves 36 and is measured with a water meter 37 and the homogenization is carried out in the branch 22. The pump can be of centrifugal or volumetric pump and the flow valve 34 is adjusts hydraulic or mechanical with transmission 6. Variation of flow pump allows watering with various dilutions / concentrations depending on plant requirements, soil / water and weather conditions. Monitoring of pump is performed with pump

water meter 37, which will count flow, a manometer 38 which indicates a gauge pressure greater than manometer 29 and a tachometer 39, which will show the default engine speed and pump flow / concentration of fertigation.
The monitoring device E is, it consists of a pressure and flow regulator 27, which maintains a constant flow rate and pressure to the system, two watermeters 26, 37, one mounted to the water supply system upstream of the pressure regulator 27 and one positioned in the injection circuit 36 to count the irrigation water and injected dejections, respectively, three pressure gauges show water pressure supply circuit 29 downstream of the pressure regulator in pump 38 and a pressure gauge watering ramp 40, the tachometer 39 for measuring the rolling speed and the sensors 41 for measuring the salinity and pH. The equipment shown on the monitor contribute to achieving the desired dilution and administration of watering rules that correspond to the desired requirements and the management of a watering rules which meet the requirements of crops. By using sensors 41, can track the quality of irrigation water, reducing environmental pollution and checking the desired dilution.

3. Operation of installation

In order drenched with diluted wastewater facility and transported by tractor trailer tank aggregate area where desired fertigation, scrolling hose with ramp and engages watering hoses with nozzles distributing the lateral pipe ramp. After that is connected to the hydrant or aggregate pumping through the hose 23, mini-pipe 28, pressure regulator 27, watermeter 26, semi-pipe 25 and transport pipe 24. The branch 22 is coupled injection circuit with a water meter 37, a check valve 36, pump D, intake circuit 31, valve 33, elbow 32 and trailer tank C. Reducing hydraulic pump flow is achieved by opening the valve 34 and the reintroduction of a quantity of slurry in tank or changes pump speed by changing the gear ratio motor-pump. During work, the combustion engine drives 1 drive the pump and the installation drum 3, meaning rolling the hose to the installation drum and the hoses with nozzles are worn on soil manure spreading diluted wastewater. When the ramp reaches the drum, motor operation, water supply and sewage plan stops , the plant ramp is suspended, disengages connections to the water supply and the circuit manure tank trailers transporting facility and a new position fertigation and the cycle repeats. If desired watering with conventional clean water will do the following. It decouples hoses 17, Figure 2, with distribution nozzles 18, Figure 4, close minivalve 16, remove the plugs 7 who are replaced by minisprinklers, manure injection circuit disengages from the non-return valve 36, Figure 1 and transmission pump D.
The equipment subject to monitoring equipment contributes to achieving desired dilution and administration of rules which meet the requirements watering plants. The ramp watering hoses and equipped with distribution devices, located apply waste water which is diluted in the growing culture and under reduced pressure. Preparation of diluted waste water by the injection of precise dosages and concentrations in small deposits in the irrigation water distribution in the soil as well as, contribute to reduce environmental pollution. Also, the sensors for measuring the pH salinity and give information that helps achieve the desired dilution flow adjustment of the injection pump. Fertigation with hosses ramp reduces evaporation and requires no washing watering crops because the distribution is at ground level. The hoses are provided with dispensing nozzles which are positioned at the end in the ground and the other end is coupled to the connectors quickly minivalve positioned on the ramp. Distribution devices are calibrated and provided with side holes for the distribution of the solution on the surface. Minivalve is provided with pipe connectors at one end and the other end of the ramp to the hose, hose, it engages only when desired application of the fertigation.

4. The technical characteristics of the installation IATF - 300 equipped with boom

Characteristic	Reel hose machine equipped with boom
1. Type installation	IATF -300
2. Type drive	- turbine -thermal engine
3.Type transmission	- mechanical gearbox - hydrostatic transmission
4. The length of watering(m)	300
5. Watering width (m) to: minimum pressure - 3.1 bar / 3.7 bar maximum pressure - 5.3 bar / 5.2 bar	 50 50
6. Device type water distribution	nozzles
7. Number distribution devices	43
8. Diameter distribution devices (mm)	6; 7; 8
9. Hydrant pressure (bar) minimum maximum	 3,7 5,2
10. The pressure at distribution device (bar) minimum maximum	 1,0 1,5
11. Turbine drive	Pelton Francis
12. Gearbox	four speed steps
13. Sprinkler flow (m3 / h): Ø 16 mm pressure and minimum / maximum pressure and 6 mm Ø 20 mm / 6 mm	 56 69
14. The watering (mm)	30-55
15. Dilution of wastewater	1:30
16. Minimum power of the tractor working in aggregate (CP)	65
17. The PTO speed (rpm)	540
18. Pressure loss (bar) on turbine to: - lower speeds of 20m / h - a speed of 20-40 m / h	 0- 0,5 0,5- 1,0
19. Hose diameter polyethylene (mm)	100
20. Thick polyethylene hose (mm)	7,5
21. Number of layers of hose	5
22. Number wheeled stroller	4-5
23. Type drive suspension mechanism trolley	manually
24. Weight system (kg) without water	 2650
25. Dimensions (mm) length width height	 5510 2070 2900
26. The area concerned day (ha)	2,5
27. Duration watering day (h)	20
28. Working capacity per cycle for 8 days (ha/cycle)	20
29. The cost of installation, euro / pc (without VAT)	Negociable

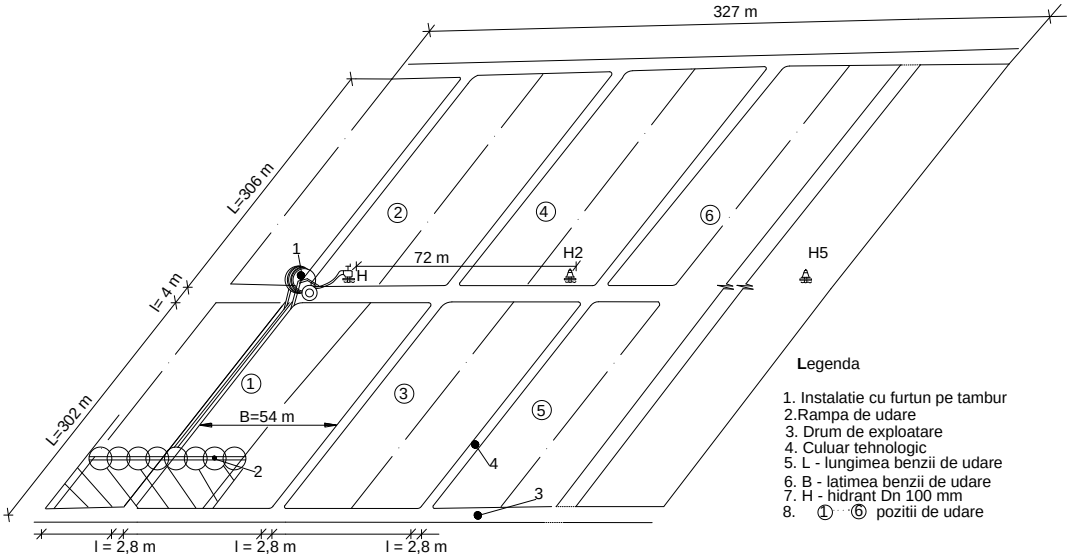

Fig. 6. Scheme watering the plant sprinkler irrigation hose drum

5. Conclusions

By applying the technical solution we obtain the following benefits:
 better homogenisation of manure-water mixture;
 there is no risk of environmental pollution by monitoring the equipment process measurement and control;
 enablessolution administration when the culture is growing;
 you can easily modify rules dilutions and watering according to plant requirements, conditions of soil / water and weather;
 localized watering at the soil surface with hose moving ramp, reduce waste and wastewater into the soil through evaporation;
 reduce the work pressure on the system because of low pressure nozzles required distribution, use of thermal actuation hose rolling of the plant and manure injections;
 reduce the amount of water supplied per unit area by distribution located;
 no loss manure transport network through the use of closed circuit of tank and injection;
 distribute small livestock manure liquid dilution as in high dilutions there is not a risk of pollution of soil and water;
 set the flow at injection is carried out continuously and with the possibility of bubbling manure in the tank to achieve a constant concentration during injection.
The main disadvantages of the technical solution are:
• transport costs can be high if the water source is the big distance (50 km);
• fertigation sown crops with high waist and short distances (less than 40 cm) is more difficult because the hoses must be moved among the rows of plants at ground level;
• the direction of movement of the ramp should be no obstruction to prevent movement;
• slurry to be used must meet the quality and to be treated.
The technical solution is in the model experimental phase and is patent Ro 123.186.

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