

## TECHNICAL-CONSTRUCTIVE SOLUTIONS FOR IRRIGATED HORTICULTURAL MICRO-FARM

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### Abstract

A drip-irrigation system - when properly designed, maintained and operated - can be a production asset for a small farm. Using drip irrigation for profitable vegetable production requires an understanding of several basic engineering and horticultural concepts and their application. The goals of this publication are to present the principles behind drip irrigation and some practical guidelines for successful and profitable use of drip irrigation. For crops irrigation at horticultural micro-farm which will be achieved at Agricultural Scholar Group Al. Vlahuta from Sendriceni-Botosani on a 4.50 ha surface, is proposed dripping water-application method, both in protected spaces and into field. In the present paper is presented the variant for micro-irrigation project for this surface. The arrangement of irrigation is constituted by a irrigation water supply pipe which alimentation with water distribution conduit from black polyethylene by high density, equip with dripper, which are constituted from micro-pipe.

At irrigation application, the distribution conduits are moved in successive positions of working, transversal by main pipe-line, at interval of time necessary for distribution of norm of water application.

The water volume through pumping from coterminous storage of farm for a discharge by 17.5 m<sup>3</sup>/h at a total dynamic head by 12.5 mCA, permit the distribution of an average norm of water application by 300 m<sup>3</sup>/ha on a 0.70 ha surface for 12 hours, the time of irrigation for total arrangement surface been by 6 days.

**Key words:** micro-farm, drip irrigation, fixed costs and annual operating.

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For irrigation of crops, in protected spaces and in field both, we propose the water dripping method. Dripping irrigation permit slowly soil wetting in zone of spreading of roots plants, with help of special installation which distribute the water, drop by drop (Alexopoulos, A., Kondylis, A., Passam HC. 2007).

Between some advantages of this method, can be enumerated:

- the water consumption which is reduced with about 40% from necessary volumes at irrigation from classic method;
- can be applied on all the category of terrain, so much looking the texture and under on the aspect of relief characteristic;
- whole growing season, the most favorable variation of moisture of soil in relation with demand of plants;
- because small discharge rate don't produced the soil erosion and don't encouraged the setting up of crust at surface of land;
- permit the application, both with water irrigation, of fertilization substances and fito-sanitary treatments;
- because from application of this method, the soil is not wet on the intervals between turns of

plants, the weeds are under developed and simultaneously, the circulation for performed of maintenance of works and in time of irrigation, without the soil be settle excessive.

### MATERIAL AND METHOD

The present study is the result of an approach to investigation and critical interpretation of comparative studies at national and international developed on the theme explored were analyzed against specific European regulations covering the production activity in the irrigated micro-farm.

At Agricultural Scholar Group Al. Vlahuta from Sendriceni, Botosani county, on a 4.50 ha surface (0.50 ha protected spaces and 4.00 ha field) is proposed a variant for micro-irrigation project through dripping water-application method.

### RESULTS AND DISCUSSIONS

The irrigation project (*figure 1, table 1*) with water it is compose by an antenna (2) which is supplied by a pumping set (1) with water from accumulation on the basis of river meadow (the medium slope of field is 2%) (Tiercelin, J.R. 1998).

The pomp is Cris type 50-40-125, and ensure the flow  $Q=17.5$  m<sup>3</sup>/h for a height by

H=12.5 mCA. The specific debit is ensured the distribution for damping norm of water application by 300 m<sup>3</sup>/h for an 0.70 ha surface in 12 hours. The watering of length for entire fitting surface is, in this case, by 6 days. The pump it is driving by an engine with strength by 1.5 kW (Thool, V.R., Srivastava, T., Thool, R.C., Ullagaddi, P.B. 2003).

The watering installation (equip with mobile distribution conduits) it is composed by (Draganescu, Ov., Ariciu, V., 1987):

- frontal ensemble (3) which contain coupling at antenna pressure;
- the conveyance-distribution pipe (4) - with 20 mm diameter and are disposed by block letter "U";
- on the conveyance-distribution pipe were foresee 16 cocks with regulator of debit (5), which are places at 25.27 and 33 m;

- the distribution conduits (6) – which have 16 mm diameter;
- watering pipe, from black polyethylene by down density, 12 mm diameter. For provided of a watering uniformity in long of the pipe, we adopt 56 m length in field. In coterminous zone we adopt two watering conduits by 34 m and for plants from greenhouses and solariums, we used conduits from 42 m length;
- dripper - 0.8 mm diameter; 0.4 m between them and an debit by 2 l/h;
- fittings and armatures for joining and ramifications.

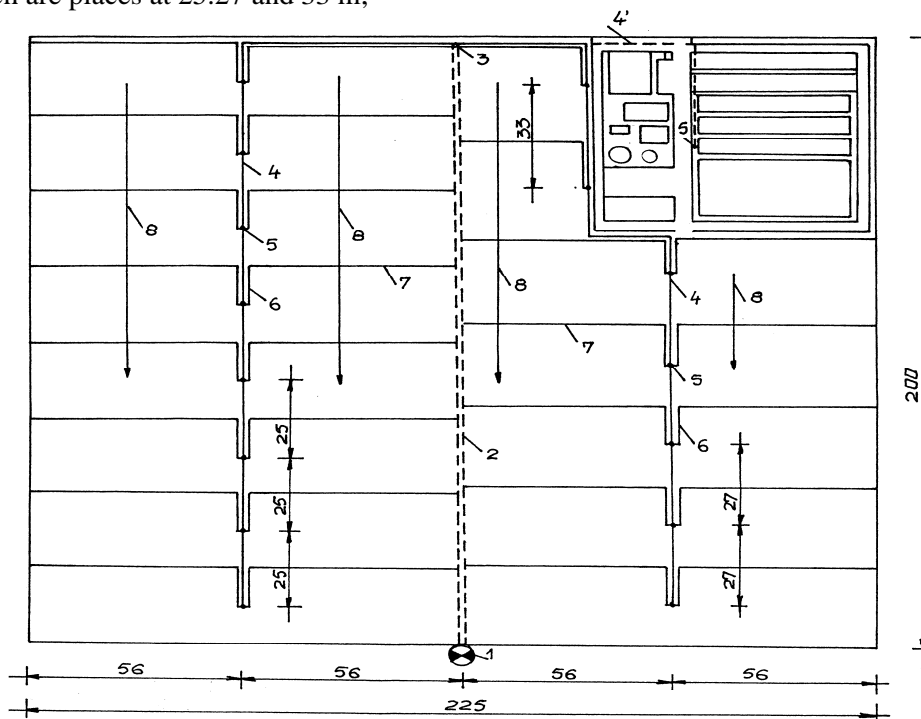


Figure 1 Local irrigation project for through watering dripping

Legend: 1 –pumping set; 2 – antenna; 3 – frontal ensemble; 4 – pipe; 4' – conveyance-distribution pipe; 5 – cock with regulator flow; 6 – coupling pipe; 7 – watering pipe outfit with drippers; 8 – move direction of distribution conduits

At irrigations applications, the watering conduits are removed in successive positions of working (8), transversal on the conveyance-distribution pipe, at necessary time for distribution of the norm of water application (Boswell J.M., 1991). Drip irrigation requires an economic investment. Drip-irrigation systems typically cost 900 - 2300 Euro or more per hectare (table 2).

Part of the cost is a capital investment useful for several years, and another part is due to the annual cost of disposable parts (Rieul L., Ruelle, P. 2003). Growers new to drip irrigation should start with a relatively simple system on a small acreage before moving to a larger system.

Drip irrigation requires maintenance and high-quality water (Geerts, S., Raes, D. 2009). Once emitters are clogged or the tape is damaged, the tape must be replaced. Water dripping from an emitter and the subsequent wetting pattern are hard to see, which makes it difficult to know if the system is working properly. Proper management of drip irrigation requires a learning period.

Water-application pattern must match planting pattern. If emitter spacing (too far apart) does not match the planting pattern, root development may be restricted and/or plants may die (Ayas, S., Demirtas, C. 2009; Fereres, E., Soriano, M.A., 2007).

Table 1

**Technical characteristics for watering dripping installation**

No	Specification	Technical characteristics
1	Type of installation	with mobile distribution conduits
2	Norm of water application	100 ÷ 300 m <sup>3</sup> /ha
3	Flow dripper	1 ÷ 3 l/h
4	Maximum pressure at equipment	2.5 daN/cm <sup>2</sup>
5	Diameter of distribution conduits	12 mm
6	Type of distribution conduits	black polyethylene by down density
7	The length of distribution conduits	34 ÷ 56 m
8	Filtration system: - gravimetric filter - filter with sieve	Two filter set , washing in reverse current Pn=4.5 daN / cm <sup>2</sup> 0.3 x0.2, two filter set, washing through disconcerting Pn=6.0 daN / cm <sup>2</sup>
9	The distance between drippers	0.4 m
10	The distance between distribution conduits	0.6 ÷ 1.0 m
11	The surface which can be irrigated simultaneous	0.7 ha
12	Maximum irrigated surface	4.2 ha
13	Minimum pressure in upstream of installation	2.5 daN/cm <sup>2</sup>

Table 2

**Estimated itemized start-up fixed costs and annual operating costs for a 2-inch-diameter drip-irrigation system for 4,5 hectares**

Drip irrigation system components <sup>v</sup>	Unit Cost <sup>w</sup> (Eur)	Quantity	Total Cost <sup>x</sup> (Eur)	Comments
<b>Installation Costs</b>				
Mazzei injector	114	1	114	
Dosatron injector	1595	1	1595	2-inch-pipe diameter, 5 - 100 gpm, 2 - 120 PSI, 1:500 - 1:50 dilution ratio
Pressure gauge	11	5	55	Actual number may vary, and range of pressure needs to match the placement in the system; one should be portable
Water meter	315	1	315	2-inch-wide water meter
Water meter fittings	8	2	16	
Water filter	66	1	66	Complete unit 2-inch 250-mesh polyester element
Backflow prevention system	308	1	308	Mandated by for fertirrigation
Ball valves	9	4	36	
Irrigation water main line	1,6	205 m	328	Schedule 40, 2-inch-diameter PVC pipe. Price may vary depending on supplier.
PVC fittings <sup>y</sup>	3	10	30	Fittings here refers to crosses and tees.
Solenoids valve	24	10	240	
Irrigation controller	190	2	380	Most controllers may control six zones
Pressure regulators	24	10	240	Pressure depends on position in the system; check that unit does not restrict flow.
Total fixed cost			3723	Calculated using a mazzei injector.
<b>Annual Costs</b>				
Irrigation water sub main line	53	370 m	189	1-inch-diameter vinyl tube (lay-flat type); may be reused based on state of repair
Drip tape	80	10 roll	800	5/8" diameter 8-mil thickness 12-inch-spacing tape
Poly-to-drip tape connectors <sup>z</sup>	38	3 bags of 100	114	May be re-used if collected and cleaned at end of season
Tape-to-tape connectors	38	2 bags of 100	76	May be re-used if collected and cleaned at end of season
Flush caps	57	3 bags of 100	171	Recommended to have. May be re-used if collected and cleaned at end of season
Replacement filters (screen only)	11	1	11	Frequency of replacement depends on maintenance
Total annual costs			1361	

Safety. Drip tubing may be lifted by wind or may be displaced by animals unless the drip tape is covered with mulch, fastened with wire anchor pins, or lightly covered with soil.

Leak repair. Drip lines can be easily cut or damaged by other farming operations, such as tilling, transplanting, or manual weeding with a hoe. Damage to drip tape caused by insects, rodents or birds may create large leaks that also require repair.

Drip-tape disposal causes extra cleanup costs after harvest. Planning is needed for drip-tape disposal, recycling or reuse.

### CONCLUSIONS

For provider the water for necessity of cultures of vegetables and flowers from Agricultural Scholar Group Al. Vlahuta from Sendriceni-Botosani, was elaborated a dripping irrigation project for 4.50 ha surface.

The arrangement of irrigation is constituted by a irrigation water supply pipe which alimentation with water distribution conduit from black polyethylene by high density, equip with dripper, which are constituted from micro-pipe.

At irrigation application, the distribution conduits are moved in successive positions of working, transversal by main pipe-line, at interval of time necessary for distribution of norm of water application.

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