Plant Archives Vol. 20, Supplement 1, 2020 pp.3565- 3572 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

ECONOMIC EVALUATION OF SUBSURFACE DRIP IRRIGATION PIPE FITTING MACHINE

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Abstract

The subsurface drip irrigation pipe fitting machine was tested and studied at a farm in Abu Ghaleb Village (Private Farm), Giza Governorate, Egypt, in the summer season 2017. The aim of this research was to study the technique and economic evaluation of the installation of subsurface pipes for the irrigation system Drip by manual method (M) as comparison method, semi-automatic method (SM), and quad-machine method (QRM) using different side distances and depths with the QRM stabilization method supported by tractor, the semi-automatic method consists of three steps: First, the drilling plow is drilled under Soil using jars, then the pipes are extended into the PU holes Middle workers, and (M) installation method by workers only to all steps of drip irrigation installed under the surface at different side distances (0.6, 1.0 and 1.4 meters) on the cost analysis for the production of maize crop.

The results showed that the production costs of maize crop in Egyptian Pound (LE) showed that net profit was higher using the subsurface drip system with SM method exceeding 10% of the surface drip irrigation system M. The net income value of the economic unit of irrigation water used (LE / m) -3) It is the highest with the use of the SM method for surface drip irrigation and QRM method compared to 50% surface drip irrigation system, 51% under both. The net income from the material unit of the irrigation water used (kg m-3) was increased by 6.6 and 5.2% using the SM subsurface irrigation method, QRM method for surface drip irrigation system. The authors recommend using subsurface drip irrigation designs (SM method and QRM method) using different side spacing synthesis because it has improved corn yield, firewood yield, net profit, and material income.

Keywords: Subsurface , Drip irrigation, Economic, Costs, QRM, Maize crop.

Introduction

Egyptian agriculture is characterized by relying on traditional methods of using irrigation water as an irrigation method for a long time since the availability of the necessary quantities of water for these methods until recently. The continuation of these methods, along with the continuous increase in population and development requirements, has led to the emergence of numerous problems and low acre productivity due to the lack of providing the actual water needs for the various field and horticultural crops, as well as the lack of sufficient water resources to expand land reclamation.

The economics of using water to irrigate Egyptian crops, especially in new lands, are the cornerstone in developing the agricultural sector vertically and horizontally as agriculture as a source of food and clothing faces limited total water supply, especially as it is the main consumer of available Egyptian water, and with insufficient water available for horizontal agricultural expansion, in addition to Continued expansion of non-irrigation uses, which leads, under the current methods of uses of water resources to non-agricultural sector, to fulfill its obligations. Which indicates the necessity of reviewing the method of using irrigation water in the fields, and setting controls for their use, taking into account the importance and value of water scarcity, which makes the study of economic evaluation of modern irrigation systems through a study of the economic efficiency of irrigation water use in agriculture Egyptian is of great importance, El-Hagarey et al. (2015) , Abd-Elmabod et al. (2019).

As a result of the majority of farmers relying on the use of traditional methods when using irrigation water, such as using a flood irrigation method, which may lead to wasting large quantities of irrigation water without benefiting from it, which may result in the lack of water standards needed to reclaim new lands, as well as the numerous attempts of some countries The Nile Basin Reducing Egypt's share of the Nile water, which requires the use of other irrigation methods that work to save the Nile water, hence the importance of this research in trying to reach the feasibility of unconventional methods to provide water used to irrigate agricultural crops, Mansour et al., (2013), Mansour et al., (2014), (2019a,b) and (2016a-c); Goyal and Mansour (2015).

One of the most important advantages of the QRM system for subsurface drip irrigation (SDI) is its high initial investment cost. SDI systems are expensive compared to other irrigation systems. The cost per acer varies greatly, depending on the size and shape of the field, the location of the water source and the level of the drip irrigation systems required. Researchers have estimated the investment cost of different irrigation systems. The net cost takes into account the allowable tax deductions based on two tax categories and the present value of those withholding applied over several years, in accordance with the tax regulations. In Nebraska, the average total cost is between $ 2,000 and $ 3,200 per hectare (hectare) well appreciated. This includes the cost of installation, which is usually about $ 800 USD per hectare. Analysis of the costs of drip irrigation systems for corn production in Illinois, USA, where the economic feasibility of drip irrigation was examined by Mansour et al. (2015a-f). Second, it updates previous estimates of capital investment, fixed ownership, and operating costs for drip-locked circuits for drip irrigation systems to produce the 2010/2011 summer season. It was found that the analysis indicated that the modified circuit DIC, CM2 and CM1, meanwhile achieved the shortest LLL, LLL1 and LLL2 highest values of net revenue earnings, net economic income from irrigation water and net material income from irrigation water.

Several studies save the costs of a tomato drip irrigation system in Florida, but only one gives cost estimates for potatoes and yield, (Tayel et al 2012 a,d, Mansour 2015, Mansour et al., 2015 a, b, c). (Mansour et al., 2016a, b, c; Mansour 2006, 2012, 2015 and Mansour and Goyal, 2015) Assessing the economic feasibility of surface drip irrigation in bed on potato production and comparing its cost to the subsurface drip irrigation system,

Drip irrigation provides many unique advantages of agricultural technologies and economic development [4]. He added that many authors studied the effect of the irrigation method and the levels of irrigation and the treatment of fertilizers and plant types on net income, that is, the net income has been estimated in some previous studies, which is due to the loss of one or more fixed costs, i.e. interest on capital costs, and land lease, Water is provided free of charge to farmers, (Goyal and Mansour 2015, El-Hagarey et al. 2015, Mansour et al (2019 a,b,c,d,), Hellal et al, 2019, Hu et al, (2019a,b).

It was found that the maximum and minimum net profit obtained from the grape crop was 3335 and 1414 pounds fed -1 under the intravenous and portal irrigation system, respectively,; Attia et al 2019, (Tayel et al. (2012a,b), (2015a-e), (2016), (2016), (2019), Mansour (2015) and Mansour et al. (2014). [7] He indicated that according to the method of irrigation, irrigation level and bean varieties, the maximum net and minimum incomes were 5751 and 2045 pounds for feeding -1, respectively. (Mansour and El-Melhem 2012, 2015) stated that the maximum and minimum net incomes obtained from the garlic crop were 4521 and 709, respectively depending on irrigation treatment and phosphorous treatment and the fertilizer injector used.

The net income from the irrigation water unit was between 1.22 and 14.14 kg of dry bean seeds m-3 from irrigation water (Mansour et al 2015 a,d, and Mansour et al 2016a,c, Ibrahim et al. 2016 and Mansour and Aljughaiman 2012, 2015). They mentioned that the maximum and minimum water prices ranged between 11.6 - 13.0 and 2.5 - 3.5 pounds per cubic meter of irrigation water used. They added that the price of irrigation under drip irrigation was affected by the varieties of the irrigation system and the level of phosphorous and beans (Vicia Faba). In western Kansas, the surface irrigation system in the United States of America was less yielding than the central pivot irrigation systems used to produce corn. Initial investment, system longevity, and corn yield affect economic returns instead of pumping costs and effective implementation, (Mansour et al., (2013),. Good irrigation management, scheduling decisions, and appropriate assessment of economic impacts at the farm level are the main impediments to adopting deficit irrigation strategies (Mansour et al., (2014), Mansour et al. (2015a-f), (2019a,b) and (2016a-c); Goyal and Mansour (2015) and El-Hagarey et al. (2015) , Abd-Elmabod et al. (2019a,b).

The research aims to conduct an economic evaluation of modern irrigation systems located in newly cultivated lands in order to obtain the best economic approach to irrigate each type of land and the crops cultivated by it. This is done by determining the effect of using a four-unit machine (QRM), a semi-automatic (SM) method, and a manual (M) method for installing side lines of the subsurface drip irrigation system for summer maize crops and winter potatoes.

Material and Method

Stages of selecting a study sample:

When selecting a study sample from the community's framework, several important principles should be achieved in order to be representative of the community, and therefore a process or method of withdrawing the sample after several main stage passes, Layout f drip surface and subsurface drip irrigation systems with two manifolds *SDI(for lateral lies s showing in Figure 1.

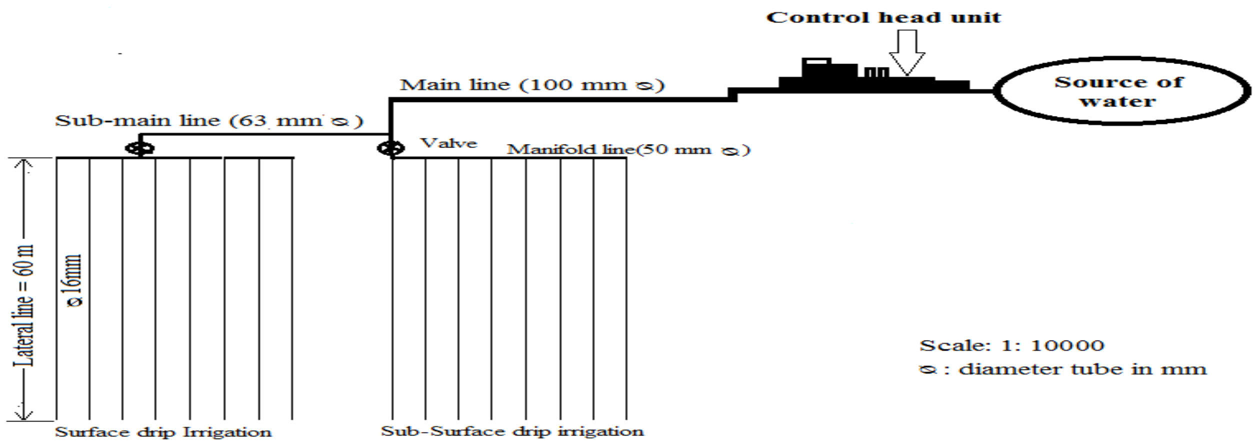

Fig.1 Layout of drip surface and subsurface systems with two manifolds (SSDI) for lateral lines.

First: Choose the study area:

The Abu Ghaleb Village (Private Farm), Giza Governorate, Egypt, was chosen to represent the study area for several reasons:

1- Considering it to be one of the reclaimed areas for a relatively long period in which agricultural production has settled and this region is considered to be among the regions of the West Delta, which is the largest land reclamation area in Egypt.

Economic feasibility, cost calculations:

1- Total production costs

Total production costs for the maize crop included irrigation costs, fertilization costs, weed control costs, and pest control costs.

The cost of irrigation

B- The capital costs of the Automatic Drip Surface Control Unit (SDI) and Subsurface Irrigation Systems (SSDI) under study have been calculated according to the 2004 market price for equipment and installation.

The annual (fixed and operational) cost of the different irrigation systems of the vineyards was calculated according to (Mansour et al., 2016a, b, c; Mansour 2006, 2012, 2015 and Mansour and Goyal, 2015).

Fixed costs

The annual fixed costs invested in irrigation systems were calculated using the following formula:
F.C = D + I + T .... (7)

Where:
FC = fixed annual cost, pounds per year,

D = average consumption, pounds per year,

I = interest, pounds per year, and

T = taxes and overhead, pounds per year.

The cost of consumption varies from system to system, depending on how old the different components are for each system. Consumption can be calculated from the following formula:
D = (I.C - Sv) / E .... (8)

Where:
I.C. = The initial cost of the irrigation system, pounds,

Sv = rescue value after depreciation, pounds, and

E = life expectancy, year.

The current interest is calculated as follows:

I = (I.C. + Sv) * I.R. / 2 .... (9)

Where
I.R. = Interest rate per year,%.

Taxes and overheads (1.5 - 2.0%) are calculated from the initial costs.

Operating costs

Operating costs are calculated from the following formula:

O.C. = L.C + E.C + (R&M) .... (10)

Where:
O.C. = Annual operating costs, pounds per year,

L.C = labor costs, pounds per year,

E.C = energy costs, pounds per year, and

R&M = repair and maintenance costs, EGP / year.

The work of operating the system and checking the system components depends on the running time of the irrigation. This time it will change from one system to another according to the rate of using irrigation water. The labor cost is estimated as follows:

L.C = T. n**.................** (1**1)**

Where:
L.C = annual labor cost, pounds per year,

T = annual irrigation time, hour / year,

N = the number of workers per hectare and

P = labor cost, pounds / hour

Energy costs are calculated using the following formula:

E.C = Bp. T. Public Relations (12)

Where:
= Energy costs, pounds per year,

Bp = brake power, kW,

T = annual operating time, h. And

Pr = cost of electric power, pounds / kw. hydrogen.

Repair and maintenance costs were considered 2, 3 and 0.5% of the initial costs for the drip irrigation system and drip irrigation and gates respectively.

Total annual irrigation costs = fixed costs + operating costs.

Fertilization costs

The vineyard fertilization process was carried out by the dropping fertilization system under the drip nozzle and the lower head and the modified irrigation using the irrigation portal tubes for ammonium sulfate and potassium sulfate and using the traditional method (top dressing) of superphosphate. The cost of fertilizing was calculated as follows:
Fr = (Wf. Pr) + Ac .... (13)

Where:
Fr = fertilization cost, lle / ha,

Wf = amount of fertilizer, kg / ha,

Pr = the price of fertilizers, pounds / kg, and

AC = fertilizer application cost, pounds / ha.

The cost of pest control

Pest control was calculated using the cost of sprinkler and pest control as follows:
Pc = (Wp. P) + Ac .... (14)

Where:
Pc = pest cost, pounds / ha,

Table 1: Capital costs of drip irrigation under the surface of the earth by manual (M) method, semi-mechanical (SM) and quadrate machine (QRM) method at distances of 1.0 meters (according to Mansour et al., 2014).

The cost of installing a sub-surface drip irrigation system	Manual	Half-unit	Four-unit
Pump unit			
For pump and variable speed drive	3213	3213	3213
Primary filter	6579	6579	6579
Irrigation control	1785	1785	1785
Fertilization pump	2482	2482	2482
Shed and slab	3519	3519	3519
The suction line (for pumping) and communications	3332	3332	3332
Cables and electrical circuits	2091	2091	2091
Subtotal (Pump Unit)	23001	23001	23001
In the field	0	0	0
Main pipes and connectors	23681	23681	23681
Valves (control, air release, cleaning)	13362	13362	13362
Secondary filtration (in each block)	1326	1326	1326
Meter (for each valve to monitor the volume)	3128	3128	3128
Drip line with emitters	55879	55879	55879
Subtotal (field)	97376	97376	97376
Installation costs	0	0	0
Tape put (about $ 350 per hectare)	6188	6188	6188
Digging trenches	7072	7072	7072
Employment fees (240 hours)	12053	12053	12053
Energy connection (approximate estimate)	3145	3145	3145
Subtotal (installation costs)	28458	28458	28458
Sideline costs	-	0	0
Deep Ripple (16 hours)	-	3468	4318
Costs of seed creation	-	5219	7650
Subtotal (installation costs)	-	6987	10268
Total capital costs	148,835	155,822	159,103

Wp = pesticide quantity, kg / ha,

P = pesticide price, pounds / kg, f

AC = pesticide application cost, pounds / ha.

The cost of weed control

Weed control was performed manually with labor and the weed control cost was calculated as follows:

WC = N. L. T .... (15)

Where:

Restroom = weed control cost, pounds / ha,

N = number of workers per hectare,

L = labor cost, pounds / hour, and

T = time used, h / ha.

Net profit

The economic profit of grape crops under different irrigation systems was calculated using the following formula, (Mansour, 2012)

P = (Yt. D) - Ct .... (16)

Where:

P = Net Profit, EGP / ha

Yt = total yield, ton / ha

D = rate of return, pounds / ton, f

Ct = total production costs, EGP / ha.

3- The unit cost of production

It was calculated as follows:

Production unit cost, (pounds / kg) =

Total costs, (EGP / ha) - Total yield, (kg / ha)

Statistical analysis

Data analysis was performed using ANOVA method using Genstat. Significant differences between treatments were determined using a significant difference (L.S.D) between systems at the 5% level. Design a complete randomized block according to (Dosbikhov, 1984).

Results and Discussion

Table No. (1) shows the capital cost in the Egyptian pound for the technical and economic evaluation of the subsurface pipes for installation of the drip irrigation system by (manual method (M) as a control method, semi-mechanical method (SM), and the method of quadruple machine (QRM)) using a different side spacing. Record your lowest-cost capital costs with the QRM ($ / 1,263 ha).

Total costs of agricultural operations are the main capital inputs for most farms. Capital costs and annual costs (fixed and operational) of the various drip irrigation system (QRM): M (manual method), SM (semi-mechanical method) and complete mechanical method by a quad-core machine (QRM) and side-line spacing LLS: (0.6, 1.0; 1.4 million On the analysis of corn production costs (total cost, total revenue, material and monetary revenue per unit that uses irrigation water in Tables 5, 7 and 8.) In Table (7) in relation to total costs, fixed costs amounted to (34.6, 33.3, 31.9%)) (40.1, 38.8, 37.4%) and (39.7, 35.7, 37.0%) under M, SM, QRM, 0.6, 1.0 and 1.4 on the other hand, operating costs To: (23.0, 23.4; 23.9%), (10.3, 10.5; 10.7%) and (10.6, 11.3; 11.1%) of the total costs mentioned in the same aforementioned sequence.

Net profit and material and cash revenues from the used irrigation water unit, and the values obtained from these criteria were: (12880, 12231; 12028 kg HA -1), (1 2619, 12011; 11867 kg HA -1), (12024, 11030; 10426 kg HA-1), (8384, 8250; 8132 kg HA-1), (8322, 8195; 8092 kg HA-1) and (8271, 8102; 8079 kg ha-1), (0.13, 0.12; 0.12 kg / m3), (0.13, 0.12; 0.12 kg / m3), (0.13, 0.11; 0.10 kg / m3), (2.2, 2.1; $ 2.0 / m3), (2.2, 2.1; 2.1 USD / M3 (and 2.1) , 2.0; $ 1.9 / m3) in the same sequence under (M, SM; QRM) and (6.0, 1.0; 1.4 m), respectively.

Table (1) shows the effect of both DIC and LLL used on total costs (LE-1- season 1 EGP), total revenue (LE-1 season -1), physical income (kg / m3) and money revenue (LE / M3). Regarding the effect of the DIC on the parameters under consideration, the DIC used can place the following descending orders: (M> SM> QRM), (M> SM> QRM), (M> SM> QRM), (M> SM> QRM), In the same sequence, respectively. On the other hand, the differences in total costs and material income between M and SM on one side and the QRM system on the other side were significant at the 5% level, while the differences in total revenue and money revenues from the irrigation unit the water used between the QRM was significant at the 5% level. In the event that LLS affects all studied parameters, LLS can be classified in the following ascending order: 0.6 <1.0 <1.4 excluding material income, while the order takes direction:

The results showed that the costs of maize production in Egyptian pounds (LE) showed that the net profits were higher using the subsurface drip system with the SM method exceeded 10% for the method of the drip irrigation system M. The value of the net income of the economic unit of irrigation water used (LE / m) -3) It is the highest with the use of the SM method for surface drip irrigation and the QRM method compared to the surface drip irrigation system at 50%, 51% below both. The net income value of the physical unit of irrigation water used (kgm-3) was increased by 6.6 and 5.2% using the sub-surface drip irrigation method SM, the QRM method for the QRM system. The authors recommend using subsurface drip irrigation designs (SM method and QRM method) using a different lateral spacing structure because it has improved corn yield, firewood yield, net profit, and material income. The maximum values, the minimum total values for costs, total revenue, material income, and cash income from the irrigation water unit used in the following interactions were achieved: (MX 0.6; QRM X 1.0), (MX 0.6; QRM X 1.4), (MX 0.6; QRM X 1.4) and (MX 0.6; QRM X 1.4), respectively. These data are agreed upon (Al-Amami et al, 2001, Tayel et al 2012 a,d, Mansour 2015, Mansour et al., 2015 a, b, c). (Mansour et al., 2016a, b, c; Mansour 2006, 2012, 2015 and Mansour and Goyal, 2015, 0.6 <1.0 <1.4. The differences in the data available between the LLS were significant at the 5% level except for between 1.0 and 1.4 million in the case of material income.

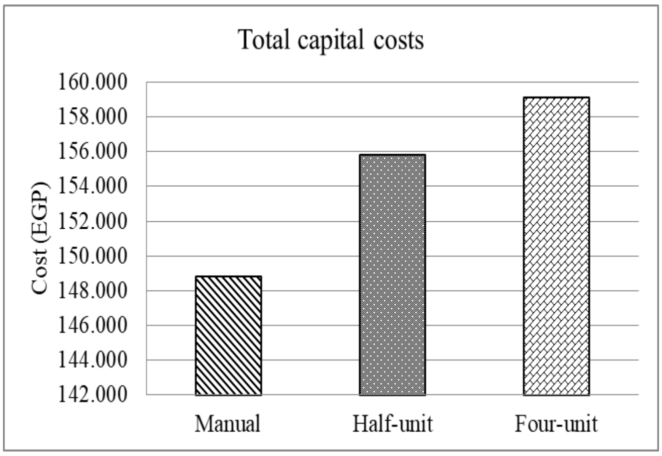

Fig. 1: The effect of installation type of subsurface drip irrigation system on total capital cost

Discussion

The underground drip irrigation pipe installation machine was tested and studied in a farm in the village of Abu Ghaleb (private farm), Giza Governorate, Egypt, in the summer season of 2017. The aim of this research was to study the technology and economic evaluation of the installation of subsurface pipes for the irrigation system Drip by manual method (M) as a comparison method, semi-automatic method (SM), and a four-way machine method (QRM) using different side distances and depths by QRM method supported by tractor, the semi-automatic method consists of three steps: First, the dig plow is drilled under Soil using jars, then the tubes are extended into the PU holes Middle workers, and (M) installation method only by workers for all steps of the installation of drip irrigation under the surface in different (0.6, 1.0 and 1.4 meters) side distances on the cost of production analysis of maize crop.

Dioudis et al, 2006, Dagdelan et al, 2009, Colaizzi et al, 2004, Dhuvitor, et al, 1995, Eldardiry et al, 2015, Zartman et al, 1992, Zeleke et al, 2011, Sagestrela et al, 2005, Musick et al 1990).

Conclusion

We can conclude that: The grain and fuel yield (Kg ha-1), LIS, and QRM used for the following ascending and descending order can be categorized: M> SM> QRM and 0.6 <1.0 <1.4. , Respectively for the parameters studied. The effect of the LIS X QRM reaction on the above yield parameters was significant at the 5% level with few exceptions. The highest cereal and straw yield values (Kg ha-1) were 12880 and 8384 Kg ha-1 and the lowest were 10426 Kg ha-1 and 8079 Kg ha-1) seen in the interactions: M X 0.6; QRM X 1.4, respectively.

Production costs of the corn crop (in US dollars), the results showed that the net profit was higher using a four-unit machine (QRM) exceeded 10% for the semi-mechanical (SM) method. The net income value of the economic unit of irrigation water used (LEM-3) was higher with the manual method (M) and the SM method compared to the QRM method by 50%, 51% below both. The value of net income from the physical unit of irrigation water used (kgm-3) was increased by 6.6 and 5.2% with manual (M) and semi-mechanical (SM) methods for a quad ore machine (QRM).

From the above mentioned, we recommend:

- Using a four-unit machine to install drip irrigation pipes under the surface at different distances and depths, because this fixing machine has improved corn productivity and production will provide, net profit, material income and water price.

- Take advantage of this device and its operating time, because what is done in 3-4 working days by workers and simple machines can be accomplished within a few hours using this device.

- Exploiting the efforts of workers in other jobs that require the presence of workers and cannot be dispensed on the farm.

- Exploiting the large costs of workers wages and providing them with other important purposes, such as reclaiming new lands.

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