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DRIP IRRIGATION: ITS WORLD WIDE EXPANSION AND IMPACT ON CROP YIELDS

M. Asghar Rana, M. Amanat Ali & M. Akhtar Abbas
Department of Basic Engineering, University of Agriculture, Faisalabad

The major crops grown through drip irrigation are fruit trees and some vegetables. It has been found that the area under drip irrigation from 1975 to 1984 has increased by four times in various countries. There is an increase in the yield of almost all the crops and the yield per unit amount of water consumed is almost double compared with furrow irrigation . Water saving from 42% to 47% has been observed when compared to traditional irrigation systems. The drip irrigated plants produced fruits earlier and gave nine times higher yield than sprinkler irrigation.

INTRODUCTION

Drip irrigation has proved more convenient, useful and an established practice in several major orchard areas of the world. The technique is versatile in its applicabiliy and can be installed on rolling sandy areas and land of uneven topography. Because of many attractive features, the technique has gained much popularity.

Drip irrigation has been devised for the application of water directly into the root zone in the forms of drops. Drip irrigation on a commercial scale began in USA and Israel in early 1960s. Positive results which became apparent within a short time brought the rapid spread of drip irrigation in most type of agricultural produce, in all types of soils and in many countries throughout the world. Drip irrigation has been adopted to some field crops and orchards including tomatoes, corn cotton, sugarcane, grapes, mangoes, etc. The system, however, is not suitable for closely planted crops such as cereals and alfalfa.

MATERIALS AND METHODS

Through the years, there has been great technological improvement which has led to the development of drippers and other drip system equipment of a very high level of reliability for all types of water and field conditions. The system, in geneal, consists in laying a plastic tube of smaller diameter on the surface of the field along the plants and delivering water to the root zone slowly but frequently from holes or special emitters located at appropriate points along the tube. The technique as developed and subsequently improved and refined by various manfacturers is shown in Fig. 1.

RESULTS AND DISCUSSION

World wide expansion: Drip irrigation was introduced in USA in 1960 when some nursery owners employed this technique in the glass house. In 1968, the system was tried in California for the growth of orchards and row crops in an area of 4 ha. The technique proved to be the most promising. The area under drip irrigation in USA and other countries continued to increase rapidly. By 1975, the area was expanded to more than 54,200 ha in USA, 17,300 ha in Australia, 10,000 ha in Middle East, 6,000 ha in Mexico, 7, 000 ha in South Africa, and to a small extent in Canada, France, Cyprus, New Zealand and United Kingdom. In some countries like Pakistan, India, China, USSR, pilot schemes were planned to study the feasibility of this system under various local climatic and environmental conditions. The total area irrigated with drip irrigation was estimated to be 0.1 million ha in 1975.

A survey made reveals a further expansion of the system to an area of 0.4 million ha which is 4 times the area reported

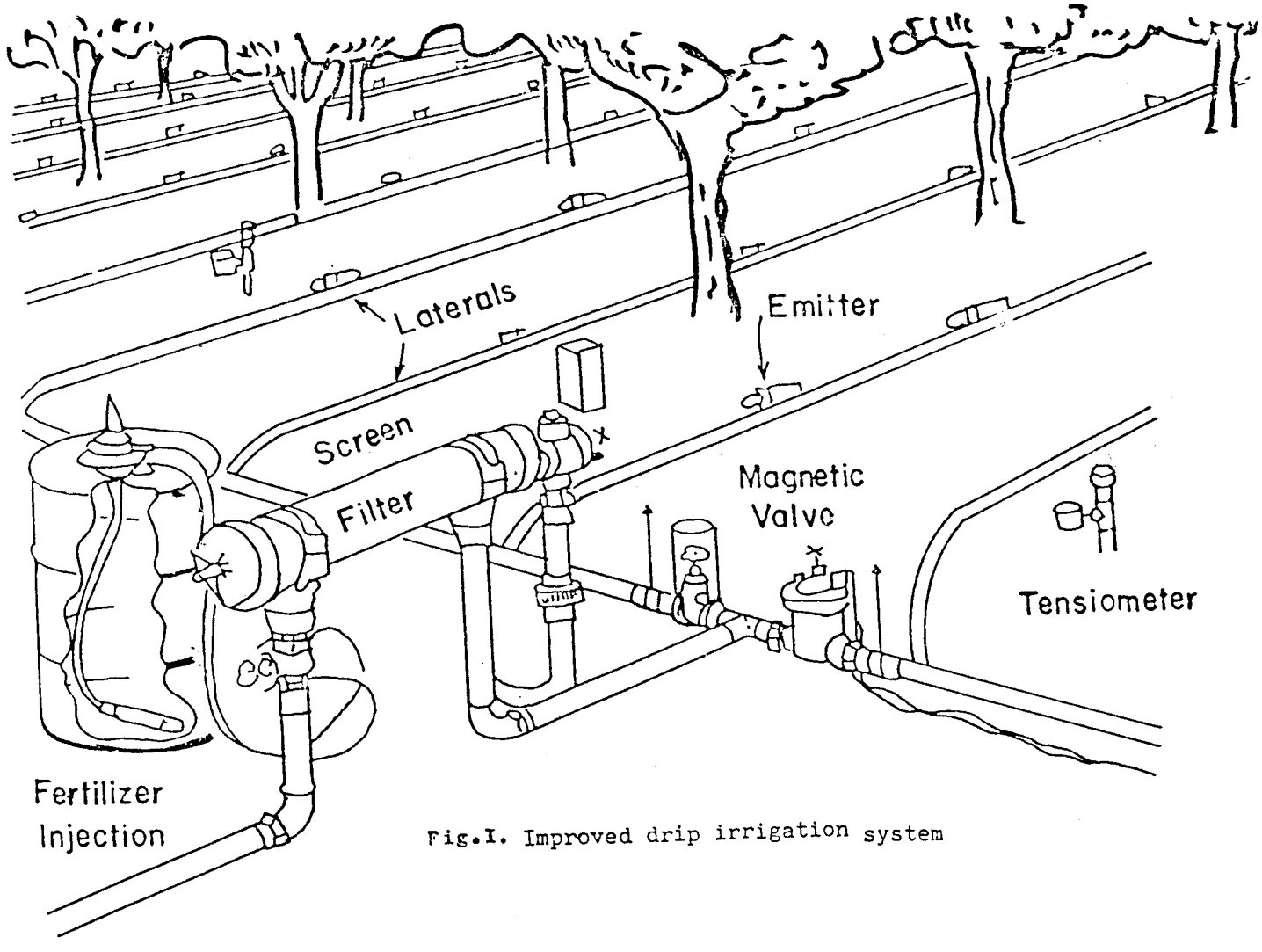

Fig.I. Improved drip irrigation system

Table 1. World-wide statistics of area under drip irrigation system

Countries	Area (ha)		Ratio 1984/1975
	1975	1984	
Argentina	152	300	1.97
Australia	17344	20050	1.16
Brazil	368	2000	5.40
Canada	405	4985	12.30
China	–	8040	–
Costa Rica	10	25	2.50
Cyprus	405	6600	16.30
Czechoslavakia	–	830	–
Federal Republic ofGermany	–	640	–
France	1235	22000	17.80
German Democratic Republic	–	205	–
India	20	20	1.00
Iran	810	800	1.00
Italy	–	10300	–
Japan	4	1020	255.00
Mexcio	5598	5500	1.00
Middle East countries	10121	81700	8.10
Morroco	–	3600	–
Newzealand	1086	1000	1.00
South Africa	7277	44000	6.0
Tunisia	–	25	–
United Kingdom	1619	3150	1.90
USA.	54136	185300	3.40
USSR	–	11200	–
West Africa	405	400	1.00
	100995	413690	4.10

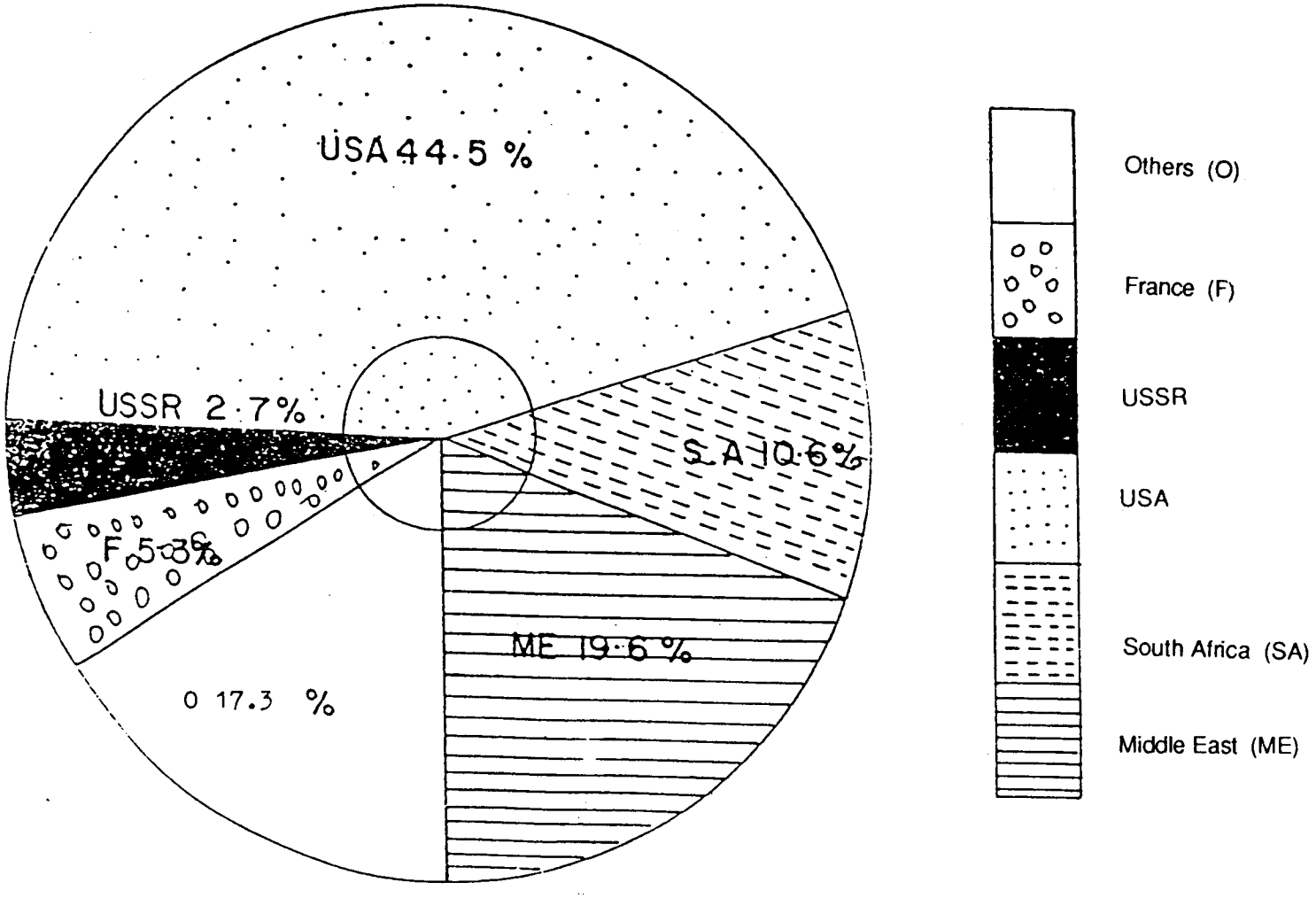

Fig. 2 World–wide percentage area under drip system in various contries

Table 2. Impact of drip irrigation on crop yield

Country	Crop	Increase %	Compared with
Middle East	Fruit trees	10–20	Sprinkler
	Vine yard	20–30	Sprinkler
	Vegetable crops	20–30	Sprinkler
	Cotton on shallow soils	30–50	Sprinkler
	Cotton on deep soils	5–10	Sprinkler
	Forage crops	25–30	Sprinkler
USSR	Fruit trees	25–34	Sprinkler
	Fruit trees	20–58	Furrow
	Tea	15–40	Sprinkler
	Potato	15–30	Furrow

Table 3. Estimation of water and yield obtained by trickle and furrow irrigation for different vegetable crops

Crops	Estimation	Furrow	Trickle	Saving (%)
Cauliflower	Water used	12.56 m^3	6.69 m^3	47
	Yield obtained	135 kg	141 kg	
	Yield per m^3 of water	10.75 k	21.1 kg	
Lettuce	Water used	4.19 m^3	2.23 m^3	47
	Yield obtained	29.3 kg	28.3 kg	
	Yield per m^3 of water	7.0 kg	12.7 kg	
Tomatoes	Water used	71.28 m^3	41.1 m^3	42
	Yield obtained	1000 kg	820 kg	
	Yield per m^3 of water	14.0 kg	20.0 kg	

in 1975 (Anonymous, 1984). Details of countrywise figures are furnished in Table 1. The technique is being used widely in Australia (20,000 ha), Canada (5,000 ha), China (8,000 ha), Cyprus (6,600 ha), France (22,000 ha), Italy (10,300 ha), Maxico (5,500 ha), Middle East (81,700 ha), South Africa (44,000 ha), USA (185,300 ha) and USSR (11,200 ha). The system in UK has also gained wide acceptance. The percentage of total area under drip irrigation in the world is shown in Fig. II. USA is at the top (44.5%), while Middle East ranks second (19.6%). These are followed by South Africa and France. The remaining area is scattered in other countries. The technique in Pakistan, however, is still in an embryonic stage. The experiments conducted on different crops in Middle East, USSR, Italy and Pakistan show that water saving with drip system is 42 to 47% as compared with furrow system as shown in Table 3.

Impact on crop yields: Drip irrigation frequently brings about larger yield and more uniform growth of the crops. The results of studies in this regard made in Middle East and USSR are given in Table 2. The data indicate an increase in the yields of almost all the crops and fruit trees in the range of 5 to 58%. In Pakistan, Hanif *et al.* (1976) studied the comparative efficiency of trickle and furrow irrigation. No substantial increase in yield levels was observed. But in terms of yield per unit amount of water consumed as shown in Table 3, in all the crops tried (cauliflower, lettuce and tomatoes), the yield per cubic meter of water consumed was higher in case of drip irrigation.

Middleton *et al.* (1979) carried out some studies on apple orchards irrigation by trickle and sprinkler. The drip irrigated plants produced fruits earlier and gave nine times higher yield (8.8 kg vs1.0 kg) than with sprinkler irrigation.

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