CHAPTER - II

REVIEW OF LITERATURE

Design and development of any machine need the background knowledge. Therefore, successful operation of any machine, one has to understand the working principle, lacking or shortfall and the way in which the operation is carried out and the physical condition of the object on which the operation is to be carried out.

The research work carried out in this direction by different scientists has been reviewed and noted under different heads as follows:

2.1 Drip irrigation technology

Narayananmoorthy (2010) studied the economics of drip irrigated cotton in Jalgaon district of Maharashtra. It was found that drip method of irrigation saves a substantial amount of water, increases productivity of crops as well as reduces the cost of cultivation. Cultivating cotton under drip irrigation provides number of different benefits to farmers over the conventional flood method. Drip irrigation reduces cost of irrigation by about 50 per cent and helps reduce the cost of weeding, intercultural and preparatory works. Water saving in drip irrigation in cotton cultivation is estimated to be about 45 per cent of flood irrigation. This also saves the consumption of electricity by about 140 kWh per acre as compared to flood irrigation. The productivity of drip-irrigated cotton is about 114 per cent higher as compared to that of flood irrigation. The profit of the cotton crop cultivated using drip irrigation is higher by about rupees 20601/acre than that under flood irrigation. The net present worth and benefit-cost ratio estimated using discounted cash flow technique shows that the investment in drip irrigation is economically viable even without the subsidy.

Raman and Tikadar (2011) found that there has been a phenomenal increase in the adoption of micro irrigation in Gujarat after the advent of GGRC (Gujarat Green Revolution Company). Between 2005-06 and 2010-11, some 1.7 lakh hectare has been brought under drip method of irrigation in Gujarat. In Gujarat, micro irrigation is being used for irrigating more than 40 different crops, some of the major crops being cotton, banana, sugarcane, potato and mango. These five crops together contribute 77 per cent
of the area under micro irrigation in the state as of March, 2011. It is estimated that between 2005-06 and 2010-11 about 706 lakh kWh of electricity might have been saved.

Palanisami *et al.* (2011) found a tremendous growth in the area under micro irrigation during the last 15 years. At present, around 3.9 million hectare area is under micro irrigation which is broken down further into 1.42 million hectares under drip irrigation and 2.44 million hectares under sprinkler irrigation. The potential for the expansion of micro irrigation in the country is immense with a projection of 42.23 million hectares as the potential area which can be brought under micro irrigation.

Elham (2014) investigated factors affecting the adoption of drip irrigation system. It was found that farmers declare that the increase of efficiency, the improvement of crop quality, the need for fewer workers, the increase of performance, the increase of surface under cultivation, the explosion of rough lands, and the uniform irrigation of farms have encouraged them to adopt the drip irrigation system. It was also found that the sprinkler irrigation increases efficiency up to 70 per cent and drip irrigation increases efficiency up to 95 per cent, while in the surface irrigation method, the water application efficiency does not exceed 50 per cent, and sometimes it is less than 35 per cent. Therefore, it is necessary to recognize factors that lead to fetch move advantage of this technology.

Chandran and Surendransing (2016) studied on positive influence of drip irrigation method adoption index by farmers. Farmers have realized yield improvement in the range of about 13 to 47 per cent through drip irrigation, or compared to surface method of irrigation for arecanut, coconut and nutmeg. High productivity and income from cultivation of crops like coconut, arecanut and nutmeg have acted as an incentive to adopt the costly system of drip irrigation in the case of both Kozhikode and Thrissur farmers. The number of drip irrigation components and type of emitters indicated a significant and linear response for drip irrigation adoption.

### 2.2 Installer and retriever machinery

Coates and Lorene (1987) studied equipment used to install subsurface trickle irrigation tubing consists of a vertical tillage tool, similar to sub-soiler, which has a channel or duct that guides the tubing into the soil. Installation is initiated by feeding enough tubing through the duct to permit securing it to the soil surface. A worker either
stands on the end of the tubing or uses a large staple to hold it in place. The implement then moves through the field inserting tubing as it travels. Upon reaching the end of the field, sufficient tubing is pulled from the reel to permit attachment to the sub main. The tubing is then cut manually and the procedure is repeated. For multi-row implements one worker is assigned to each pair of sub-soiler shanks. A tractor operator and a worker positioned at each end of the field to assist with the cutting, feeding and reel changing operations complete the labour force required for installation. This results in a labour intensive operation with six workers required for a six-row implement. Field observation indicated a potential problem with these implements.

Bida (1998) developed and evaluated the manual drip line retriever and it was observed that the average length of 200 m drip line retrieved in 3 minutes 20 sec but it was reported that during the retrieving the drip lines roll over and come from reel. Also, it was stated that the speed of retrieving was constant throughout the length. It was also observed that the average speed of retrieving during first segment at 1/3 length of drip line was 0.58 m/s and for the last segment, it was observed at 0.83 m/s which is nearly doubled of the first segment.

![Fig. 2.1 Working of pedal operated drip line retriever](image)

Karale et. al., (2016) It was observed that the average field efficiency of the tractor operated drip line retriever was 87 per cent and for manual retriever was found to be 78.26 per cent, whereas in hand retrieving it was observed as 63.46 per cent. The cost of retrieving operation in tractor operated drip line retriever was observed as ₹ 468 per hectare where as in manual retriever and hand retrieving operations it was found to be ₹ 650 per hectare and ₹ 1280 per hectare respectively. Net saving in cost with tractor
operated drip line retriever was worked out and it was observed that as 28 per cent and
63.43 per cent over manual retriever and hand retrieving method, respectively.

![Image ofuish download]

Fig. 2.2 The retrieving of drip line

Taley et al., (2006) developed manual coiler and tested for its performance with
150 m long segment of drip lateral in the field and reported that overall performance of
machine was good in terms of field capacity, field efficiency, and reduction in cost.
Developed a device mounted to three-point hitch, which performance both the
operations like installation and retrieval.

Zhu et al. (2004) developed a device mounted to three-point hitch, which
performance both the operations like installation and retrieval in one unit. The retriever
mainly consists of a speed reducer, a power transmission line, a drip tape distributor,
drip tape spool supporters, water extractors, tensioners, and drip tape guides. The
installer mainly consists of a chisel, a press wheel, a tape depth adjustment screw, a
tension spring, two soil cover plates, and a tangling prevention ring holder. During the
installation process, drip tapes are placed in shallow trenches cut by the 5 cm wide
chisel and are covered with soil by 6.5 cm wide pneumatic wheels. The depth of drip
tapes can be adjusted from 0 to 5 cm beneath the soil surface. During the drip tape
retrieval process, drip tapes are distributed evenly across rotating spools while any
water in the tapes is squeezed out. The retrieval speed is adjusted by changing the tractor
PTO (Power Take Off) speed. To retrieve excess disposable drip tapes, a special spool
was developed to quickly remove the tapes from the unit. No tools are needed for either
installing or removing drip tape spools. Mathematical models were developed to
calculate drip tape length, retrieving time, and spool sizes. Speeds of both retrieval and
installation increased as the total number of laterals per hectare decreased, or as the field length increased.

![Fig. 2.3 The implement for install drip line](image)

### 2.3 Hydraulic motor

The patent was taken for a motor driven wire roller as attachment to a three-point hitch of a farm tractor (Anon., 1984). The apparatus includes an elongated shaft, having a motor attached to rotate one end of the shaft and a wire drum having the central axis thereof attached to a medial part of the shaft so that rotation of the shaft by the motor imparts rotational motion to the wire drum. A wire guide having drag plates associated therewith is included in the apparatus. The entire apparatus is easily assembled to the tractor through three-point hitch. Stringing out barbed wire and retrieving the wire after it has been used is a very cumbersome and dangerous task. The wire, which is sometimes a slick line, and at other times barbed wire, usually comes in quarter mile rolls. Each roll weighs 50-80 pounds, motor is able to retrieve it.

![Fig. 2.4 Hydraulically actuated wire roller for a tractor](image)
Coates (1986a) derived that the control of reel peripheral velocity during installation of drip irrigation laterals is a major problem with the present equipment. An improved braking system was developed using a rotary hydraulic actuator in a closed loop circuit in combination with a caliper disc brake. Laboratory evaluation indicated improved performance for implement speeds of 3 kmph to 16 kmph.

2.4 Economic analysis

Witney (1988) reported that, the machine fixed costs include the interest on capital, which is invested in the machine. If the capital is borrowed, an expected inflation is included in the interest rates. A charge is made even if the capital is already owned, because money could be earned from an alternative investment. The costs when owned capital is invested are called opportunity cost of capital. Interest charges can be calculated as an equal yearly charge through the life of the machine. The real cost of borrowing can be reduced by both inflation and tax allowances.

2.5 Salient features of review

From the literature reviewed, on installation and retrieving operation of drip line, drip pipe & physical properties of bundle and schedule for different crops. Combinations of installation and retrieval of drip line was reported to give better result with minimum time, lesser energy as well as draft and fuel and with use of mechanical device was also economic.