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*Research Paper :*

# Design, farbrication and field testing of sand filling system to the mole plough

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## ABSTRACT

The subsurface drainage system is highly expensive and may not be affordable to the small, medium size farmers, whereas the wastage of land, maintenance are the big problems with the surface drainage system. Keeping these points in view, a mole plough was designed and then further modified with the additional sand filling system. The field tests were conducted in the heavy clay soil with 1.5 % slope. A 60 Hp tractor was selected and operated with modified mole plough in I-L gear .The speed of operation was 0.75 Km/hr .The mole channels were formed as 3 m wide spacing and to a depth of 55 cm .The rate of coverage was calculated on the basis of length of mole channel. An auxiliary fuel supply system was utilized for the measurement of fuel consumption. The cost of formation of mole channels was calculated by straight line method. The result of the tests were collected, analyzed and reveled that, the sand filling system designed works suitably with a fuel consumption of 0.3 lit/100 m length of mole channel. The cost of operation was Rs. 9450 /ha while operating at 3 m spacing of mole drains the % filling of mole channels was 77.59 per cent.

**Key words :** Mole plough, Sand filling system

Mole drains are unlined circular soil channels, which function like pipe drains. Mole drainage is an effective method of drainage, which is widely used in the clay soils of temperate region such as United Kingdom, northern Europe and in New Zealand (Aulifte and Home, 1994). It is generally confined to soils having clay content of about 30-35%. Their diced is their restricted life (5 to 10 years), but, providing benefit cost ratios are favorable, a short life can be acceptable. Mole drains are formed with a mole plough, which comprises a cylindrical foot attached to a narrow leg, followed by a slightly larger diameter cylindrical expander. The foot and expander from the drainage channel and the leg generates the shot with associated soil fissures which extend from the surface down into the channel. The leg fissures are vertical and formed at an angle of approximately $45^0$ to the direction of travel.

Mole drains are commonly installed at depths between 0.4 and 0.7 m, but can be installed up to depth of 1.2 m. The mole drain spacings range between 2 to 5 m. Common length of mole drains vary from 20 m to 100 m long depending on the grade, which may range from nearly level to 5 per cent. Mole drains are installed using a mole plough, pulled by a powerful tractor (drawbar pull 40-60 KN). The success of a mole drainage system is dependent upon satisfying two requirements achieving the desired water flow path for the particular drainage situation, and installing stable mole channels.

The cost of installation of sub-surface system depends mainly on the drain spacing. Draining of heavy clays soils require closer spacing due to poor physical properties of the soil. The high initial cost of pipe drainage resulted in few adopters of the subsurface drainage technology. A viable alternate to pipe drainage could be mole drainage. The life of these drains is short as compared to pipe drainage, which needs to be improved. The life of mole channels can be improved by filling of sand in the moles during formation. So the study was undertaken to design, fabricate and evaluate the sand filling system (Anonymous, 1999).

## METHODOLOGY

The field tests were conducted in heavy clay soil with 1.5 % slope. A 60 Hp tractor was selected and operated with modified mole plough in I-L gear. The average speed of operation was 0.75 Km/hr. The mole channels were formed at 3 m wide spacing and to a depth of 55 cm. The rate of coverage was calculated on the basis of length of mole channel formed. An auxiliary fuel supply system was utilized for the measurement of fuel consumption. The cost of formation of mole channels was calculated by straight line method.

### *Consideration and calculations for the design of sand filling system :*

Shape of mole cross section = Circular

Diameter of mole channel = 75 mm

Cross sectional area of mole channel = 4.415 x