Sustainable agriculture for the future

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Mechanization considerations for drip irrigation systems

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Climate change is leading to increasing water scarcity. Agriculture is the biggest user of water in South Africa. Appropriate methods and systems of irrigation are, therefore, critical to the objectives of achieving higher irrigation efficiency to achieve the much-needed savings in water usage. To achieve water savings and remain profitable, farmers must pay careful attention to how their chosen irrigation systems affect other operations on their farms; how the chosen irrigation systems affect mechanization activities such as planting and harvesting operations. Precision agriculture uses modern methods for mechanized operations in the farming enterprise. In this article, the focus is to discuss how drip irrigation system affects mechanization operations and how a combination of precision agriculture and modern drip irrigation system design can lead to optimal irrigation and mechanized operations resulting in reduced costs and increased profitability.

Drip lines with space in the field for tractor way

Spraying of a maize field with liquid fertilizer using a drone

- **Land preparation:** The drip is typically considered a permanent irrigation system because the system is not moved for at least the entire growing season and can stay in place for several growing seasons. Since the system stays in same place for a considerable period, careful consideration must therefore be given to the layout of the system such that there will be pathways for example for mechanization equipment such as tractors and other farm machinery. To achieve this special tools and case consideration as discussed below need to be applied.

  - GIS Mapping: The use of Geographic Information Systems software to precisely map the farming field and area for irrigation has emerged as a popular system for precision agriculture. Every area of the field is mapped to within a cm to optimize the planting area while making clear layouts of where the tractor wheels must pass. To achieve this, the type of tractor (two wheels or four wheels) as well as tractor width should be known for the precise design of the layout.
  - Crop type: Drip irrigation is popular in orchard farming due to the ability to directly target the root zone of the orchard. In addition, land preparation for orchards happens once in their production life span. With orchards harvesting equipment also need access to the field. This in the form of trucks rather than harvesters. Thus, some of the pipes may have to be buried under ground to ensure access of heavy equipment. This can be achieved through a combination of precise mapping and design to ensure optimized access points and routes in the field.

- **Skilled labour:** Handling or the ability to operate precision agriculture equipment requires highly skilled operators. Use of unskilled labour can easily cause damage

to the irrigation pipes, which are quite expensive. Tractor wheels can also damage the pipes if the driver is not sufficiently skilled. The drip irrigation system is expensive to install and fragile to operate; hence, this system needs literate handlers who are good with numbers to control the irrigation scheduling with assistance of appropriate software. In addition, combining mechanization planning with optimal irrigation scheduling requires a skilled overall farm manager. Therefore, all levels of labour must be skilled to achieve optimal results in terms of asset utilization while minimizing water use with the drip irrigation system.

- **Weeding and pest control:**
  - Drone spraying technologies: Drone spaying is a new method of spraying and is ideally suitable for drip irrigation because there is no ground movement of equipment during spraying. The challenge with drone spraying is mostly due to regulation as operating license can be a challenge to obtain as well as the associated costs.
  - Elevated spraying vehicles: This specialized equipment has thin enough wheels to pass in between rows, while being elevated enough to be above the crop. The irrigation layout and selection of the equipment must both be considered to ensure synergy when operating the drip irrigation system as the pipe layout is of a permanent nature.
- **Harvesting:** Drip irrigation may be unsuitable for crops such wheat which have a specialized harvesting equipment and tight spacing. The harvester header is very low during harvesting thus pipes cannot be above ground. In addition, costs may be prohibitive since wheat is grown in larger hectare.

In summary: Drip irrigation is preferred in high cash crops such as orchards where spacing for mechanized equipment is easier to achieve and land preparation activities are infrequent.

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Weed sprayer