

Fertigation: Innovations in Micro Irrigation Technology

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SUMMARY

Fertigation is the application of fertilizers through irrigation system and is the most advanced and efficient practice of fertilization. Drip system is the most adopted and effective way of fertigation for efficient use of fertilizer and irrigation water. Fertigation remarkably improves fertilizer and water use efficiency and with higher crop yield and quality. Selection, solubility, and compatibility of fertilizers in fertigation system, scheduling fertigation according to crop need.

INTRODUCTION

Fertigation is a method of fertilizer application in which fertilizer is incorporated within the irrigation water by the drip system. In this system fertilizer solution is distributed evenly in irrigation. The availability of nutrients is very high therefore the efficiency is more. In this method liquid fertilizer as well as water soluble fertilizers are used. By this method, fertilizer use efficiency is increased from 80 to 90 per cent.

Fertilizer efficiencies of various application methods

Nutrient	Fertilizer use efficiency (%)	
	Soil application	Fertigation
Nitrogen	30-50	95
Phosphorous	20	45
Potassium	50	80

Fertilizer used in fertigation

- Urea, potash and highly water soluble fertilizers are available for applying through fertigation.
- Application of super phosphorus through fertigation must be avoided as it makes precipitation of phosphate salts. Thus phosphoric acid is more suitable for fertigation as it is available in liquid form.
- Special fertilizers like mono ammonium phosphate (Nitrogen and Phosphorus), poly feed (Nitrogen, Phosphorus and Potassium), Multi K (Nitrogen and Potassium), Potassium sulphate (Potassium and Sulphur) are highly suitable for fertigation as they are highly soluble in water. Fe, Mn, Zn, Cu, B, Mo are also supplied along with special fertilizers.

Fertilizers commonly used in fertigation

N %	P ₂ O ₅ %	K ₂ O %
19	19	19
20	20	20
11	42	11
16	8	24
19	19	19
15	15	30
12	61	0
13	0	46
0	52	34
0	0	50

Nitrogen fertigation

Urea is well suited for injection in micro irrigation system. It is highly soluble and dissolves in non-ionic form, so that it does not react with other substances in the water. Also urea does not cause precipitation problems.

Urea, ammonium nitrate, ammonium sulphate, calcium ammonium sulphate, calcium ammonium nitrate are used as nitrogenous fertilizers in drip fertigation.

Phosphorus fertigation

Application of Phosphorus to irrigation water may cause precipitation of phosphate salts. Phosphoric acid and mono ammonium phosphate appears to be more suitable for fertigation.

Potassium fertigation

Application of potassium fertilizer does not cause any precipitation of salts. Potassium nitrate, Potassium chloride, Potassium sulphate and mono potassium phosphate are used in drip fertigation.

Micro nutrients

Fe, Mn, Zn, Cu, B, Mo could be used as micro nutrients in drip fertigation.

Advantages

- Eliminates manual application.
- Quick and convenient.
- Uniformity in application.
- High efficiency and saving of fertilizer up to 30 - 40%.
- Less fertilizer leaching.
- Better penetration of P and K in the layers.
- Co-ordination of nutrition requirement with crop stage or development.
- Possibility of dosage control.
- Others like herbicides, pesticides, acid, etc can also be applied

Limitations

- Toxicity to field workers.
- Chance of backflow into water source, for that NRV and vacuum valve has to be installed. Insoluble fertilizers are not suitable (super phosphate).
- Corrosive effect of fertilizer.
- Phosphate may get precipitated in the pipe line and dripper due to pH reaction.
- High cost

Equipment and Methods for Fertilizer Injection

Injection of fertilizer and other agrochemicals such as herbicides and pesticides into the drip irrigation system is done by i) By-pass pressure tank ii) Venturi system and iii) Direct injection system.

By-pass pressure tank

This method employs a tank into which the dry or liquid fertilizers kept. The tank is connected to the main irrigation line by means of a by-pass so that some of the irrigation water flows through the tank and dilutes the fertilizer solution. This by-pass flow is brought about by a pressure gradient between the entrance and exit of the tank, created by a permanent constriction in the line or by a control valve.



Venturi Injector

A constriction in the main water flow pipe increases the water flow velocity thereby causing a pressure differential (vacuum) which is sufficient to suck fertilizer solution from an open reservoir into the water stream. The rate of injection can be regulated by means of valves. This is a simple and relatively inexpensive method of fertilizer application.



Direct injection system

With this method a pump is used to inject fertilizer solution into the irrigation line. The type of pump used is dependent on the power source. The pump may be driven by an internal combustion engine, an electric motor or hydraulic pressure. The electric pump can be automatically controlled and is thus the most convenient to use. However its use is limited by the availability of electrical power. The use of a hydraulic pump, driven by the water pressure of the irrigation system, avoids this limitation. The injection rate of fertilizer solution is proportional to the flow of water in the system. A high degree of control over the injection rate is possible, no serious head loss occurs and operating cost is low. Another advantage of using hydraulic pump for fertigation is that if the flow of water stops in the irrigation system, fertilizer injection also automatically stops. This is the most perfect equipment for accurate fertigation.



CONCLUSION

This innovative technology in fertilization is highly recommended to save natural resources from depletion, and protect the environment from pollution by agricultural contaminants. Fertigation using injectors is considered an effective technique in agricultural production as the application rates of fertilizers and irrigation water can be significantly reduced, and crop yield can be increased appreciably.

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