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A Review: Effect of Fertigation in Flower Crops

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Introduction

India is poised to play a major role in increasing the utility of land water and other natural resources to compete with the increasing rate of population. In agriculture, all the metabolic functions of plant require optimum water and nutrients for higher productivity. A huge share of water is engaged in Agriculture. Water resources in the world are either dropping or contaminated by industrial waste discharge. A large cost in agricultural productivity is of fertilizers which are applied into farm to get higher yield.

The visual quality of flower crops is necessarily linked to an adequate balance of nutrients. Plant height, shape and coloration are qualitative aspects of flowers, directly influenced by mineral nutrition, among other environmental aspects. For flower crop, to get maximum yield with good quality flower, scheduled fertilizer application is highly inevitable. Intensification of agriculture by irrigation and enhanced use of fertilizer may generate pollution by increased level of nutrients in groundwater and surface waters. A higher efficiency is possible with the help of pressurized drip irrigation system is placed around the plant roots uniformly and allow for rapid uptake of nutrients by the plant. Small application of soluble nutrients saves labour reduces compaction in the field, thereby enhancing productivity.

Fertigation

Applying plant nutrients by dissolving them in irrigation water (termed as fertigation) particularly with the drip system is a most efficient way of nutrient application. Fertigation has the potential to supply a right mixture of water and nutrients to the root zone, and thus meeting plants' water and nutrient requirements in most efficient possible manner (Patel and Rajput, 2001). Fertigation allows the crops to use up to 90 percent of the applied nutrients. Fertigation ensures saving in fertilizer (40-60 percent), due to "better fertilizer use efficiency" and "reduction in leaching".

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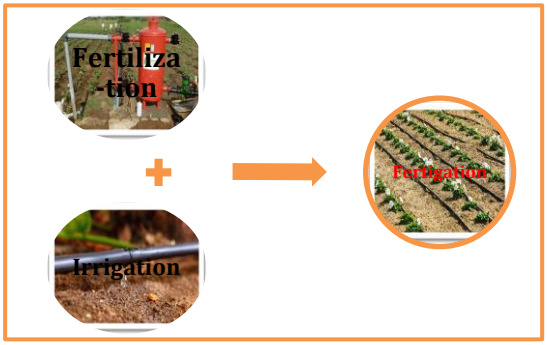

Advantages of Fertigation

- Higher nutrient use efficiency
- Helps in effective weed management
- Elimination of manual application
- Higher resource conservation
- Stage wise availability
- Efficient delivery of micronutrients
- Healthy crop growth
- Uniformity in application
- Effectively use in undulating soil
- Improved soil structure

Drawbacks of Fertigation

- Initial investment is high
- Chemical reaction in drip system leading to corrosion and precipitation of fertilizer
- Clogging of emitters
- Lacking the information
- The Fertigation material is either not available in desired form or available at higher price
- Lack of knowledge about chemical technique
- Require safety measure

Precautions to be taken during Fertigation

- Perfect design of irrigation system.

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- Every emitting point must deliver the same volume of water
- The material used must be free from deposits or residues and must not cause corrosion of system
- Selection of most appropriate fertilizer, injection system and crops for Fertigation
- Fertilizers/pesticides/chlorine should not be injected at the same time
- Fertilizer injection should not begin until all lines are filled with water
- Constant operating pressure to facilitate uniform mixing of water and fertilizers
- Do not over irrigate

Fertilizers commonly used for fertigation

Nutrients	Fertilizers	% Nutrient	Solubility (g/lit)
N	Urea	46 % N	1100
	Ammonium nitrate	34 % N	1920
	Ammonium sulphate	21 % N	760
N and P	Mono ammonium phosphate	12 % N, 61 % P_2O_5	282
P and K	Mono potassium phosphate	52 % P_2O_5, 34% K_2O	230
K	Potassium chloride	60 % K_2O	347
	Sulphate of potash	50 % K_2O, 17.5 % S	457
	Potassium nitrate	13 % N, 46 % K_2O	316
Ca	Calcium nitrate	16 % N, 19 % Ca	1290

Fertilizer Use Efficiency (%)

Sr. No.	Nutrients	Soil application (%)	Drip + Soil application (%)	Drip + Fertigation (%)
1	Nitrogen	30-50	65	95
2	Phosphorus	20	30	45
3	Potassium	60	60	80

Characteristics of fertilizers suitable for fertigation

- No drastic change of water pH

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- No clogging of filters and emitters
- Low content of insoluble (<0.02%)
- Compatible with other fertilizers
- Water soluble at field temperature condition
- Readily available to the plants
- High nutrient content
- Minimal interaction with irrigation water

Brief review of research work

- **Rose:** Bisht *et al.* (2013) studied on interactions between growing media and nutritional doses in rose cv. Grand Gala and observed maximum numbers of flowers (79.05) with G_3F_3 and minimum number of flowers (24.67) with G_5F_4 which is control.
- **Gladiolus:** Yadav *et al.* (2020) reported that irrigation of 0.6 CPE by drip + 80% RDF recorded minimum days to 50 % flowering (82.67) and days to full bloom (19.33) as well as maximum spike length (80.12 cm), diameter of basal floret (13.08 cm) and number of spikes per plant (22.67) from the same treatment.
- **Gerbera**: Salma *et al*. (2014) studied thequality, yield and vase life of gerbera as influenced by the fertigation levels and recorded minimum days to flower bud opening, maximum flower stalk length (60.33 cm), flowering diameter (10.48 cm), yield/m^2/month (36.15) and vase life (10.61 days) with the application of 100 % WSF.
- **Chrysanthemum:** Jawaharlal and Ganesh (2020)studied on flowering parameters of chrysanthemum var. Punch and observed minimum day taken for first flower bud appearance (45.27), maximum flower stalk length (132.24 cm), number of flowers per stalk (14.42) and marketable stem yield /m^2 (77.68) with application of 75 % RDF @ 12:3:12 g NPK/m^2 + Foliar spray of 0.2 % EDTA chelated micronutrient mixture.
- **Carnation:** Dhinesh *et al.* (2014) observed minimum days to first flower bud opening while maximum length of flower stalk (cm), opened flower diameter, number of flower buds per plant and marketable flower yield/m^2 with the application of 100 % RDF @ 80:20:110g NPK/m^2 + Foliar spray of 0.2 % EDTA -chelated micronutrient mixture in carnation.
- **Tuberose:** Kumar and Ganesh (2020) observed that application of 100 % RDFTF + MC @ 12.5 kg/ha+ 3% Panchagavya + 0.4 % Humic acid produces maximum flower yield

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(6.20 and 6.50kg/plot) and 100 flower weight (178.18g and 187.38g) during 2015-16 and 2016-17 respectively in tuberose var. Prajwal.

- **Marigold:** Kurakula*et al*. (2018) revealed that application of 75% of RDF with WSFs produces maximum plant spread (EW- 41 cm, NS- 11.52 cm), stem girth (8.41 mm), flowering duration (45.74) and no. of pickings (5.10) in marigold cv. PusaNarangiGainda.
- **Jasmine:** Keerthi shankar *et al*. (2020) observed that jasmine flower fertigated with100 percent water-soluble fertilizers through fertigation with a foliar spray of Humic acid, Chelated Zinc and Borax produced maximum 100 Bud weight (29.92g), flower yield per plant (725.80g) and flower yield per hector (3.23 t).

Conclusion

Floriculture sector is generating higher income and employment opportunities, promoting domestic market and exports. NPK application in the form of fertigation enhanced various growth indices and increased flower yield in most of the important flower crops. Water and nutrient losses are reduced and decrement in weed growth therefore allows plant to accumulate more water and nutrients with increased uptake thus enhances the growth and yield of the crop and moreover the economic status of a farmer. Among all irrigation methods, drip irrigation and fertigation is the best method as it increases 60-80 % yield, 40–60 % WUE and 40–80 % fertilizer use efficiency. Application of 100% RDF through water soluble fertilizers recorded maximum values of flowering and yield parameter in important flower crops like gerbera, tuberose, carnation and marigold. Drip fertigation is most suitable alternate where the water scarcity is major problem.

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