

Original Research Article

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## Economics of Gerbera Cultivation Grown under Polyhouse Conditions as Influenced by Foliar Application of Nano and Conventional Micronutrients (FE and ZN)

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### ABSTRACT

#### Keywords

Gerbera,  
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#### Article Info

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Benefit cost ratio is an important factor which decides the optimum level of inputs to be used for maximization of production and returns in any crop. In the present study, the benefit-cost ratio was worked out for different concentrations of nano and conventional micronutrients (Fe and Zn) used in the study (T<sub>1</sub>- Nano ZnO @ 300 ppm, T<sub>2</sub>- Nano ZnO @ 200 ppm, T<sub>3</sub>- Nano FeO @ 300 ppm, T<sub>4</sub>- Nano FeO @ 200 ppm, T<sub>5</sub>- Bulk FeSO<sub>4</sub> @ 0.2%, T<sub>6</sub>- Bulk ZnSO<sub>4</sub> @ 0.2%, T<sub>7</sub>- Nano ZnO @ 300 ppm + Nano FeO @ 300 ppm, T<sub>8</sub>- Nano ZnO @ 300 ppm + Nano FeO @ 200 ppm, T<sub>9</sub>- Nano ZnO @ 200 ppm + Nano FeO @ 300 ppm, T<sub>10</sub>- Nano ZnO @ 200 ppm + Nano FeO @ 200 ppm, T<sub>11</sub>- Bulk ZnSO<sub>4</sub> @ 0.2% + Bulk FeSO<sub>4</sub> @ 0.2%, T<sub>12</sub>- control (Water spray)). The results revealed that T<sub>8</sub>- ZnO @ 300 ppm + FeO @ 200 ppm recorded maximum net returns (lakh Rs. 93.82 ha<sup>-1</sup>) with higher B:C ratio (1:3.68) whereas T<sub>12</sub>- control recorded minimum net returns (lakh Rs. 46.71 ha<sup>-1</sup>) with lower B:C ratio (1:1.85).

### Introduction

Floriculture is a fast emerging major venture in the world, especially as a potential money-spinner for many third-world countries. Modern-day floriculture refers to the

production of high-value cut flowers such as rose, gladiolus, carnation, gerbera, orchids, tuberose, anthurium, liliun, etc., Now a days, growing of these cut flower crops, suited for flower arrangements, decorations, for bouquets preparation and for floral baskets

have increased substantially and its share of the total trade has also improved. India ranks second next to China under cultivation in floriculture with an area of 3.2 lakh hectares and produces 19 million tonnes of loose flowers and 8.2 million tonnes of cut flowers annually (NHB, 2018).

Many cut flowers and ornamental plants are being grown for domestic as well as for export market, provide more return per unit area than any other horticultural crops. Among cut flowers, gerbera currently ranks as the fifth most popular flower in the world after the roses, carnations, chrysanthemums and tulip.

Gerbera can contribute largely to floriculture industry by virtue of its yield potential, colour variation and long vase life. Cultivation of Gerbera under polyhouse has emerged as a very important option to progressive farmers in a many parts of India.

But farmers are facing some problems in gerbera cultivation such as environmental and technological changes, disease pest infestation and physiological disorders caused by micro nutrient deficiencies which reduces the quality, yield and ultimately the net returns. So commercialization of gerbera by using modern technologies will improve the cultivation condition and also enhances the quality and yields.

Recently, Nanotechnology is gaining a lot of importance and has been used in all stages of crop production. Foliar application of nano micronutrients also enhances the yield, quality of flowers and also gives higher benefit cost ratio. The main objective of the present study was to analyze the cost of production of gerbera grown under polyhouse as influenced by foliar application of nano and conventional micronutrients which was helpful to farmers in raising the net returns.

## **Materials and Methods**

The experiment was carried out in naturally ventilated polyhouse located at floriculture block, College of Horticulture, Anantharajupeta, Dr.Y.S.R District. The frame of polyhouse was constructed with galvanized iron pipe with side and top ventilation, a rollable flap was provided on both sides of the polyhouse to regulate the requirements of temperature and humidity depending on the season and weather conditions. A uv-stabilised low density polyethylene film of 200 micron was used as cladding material. The sides of the polyhouse were covered with anti-insect proof rambonet of 60 mesh for natural ventilation and protection against insect pests. Manually operated 50 percent (white colour) shade net was provided inside the polyhouse to regulate the light intensity and temperature. To control the humidity in polyhouse the fogging arrangement was made by providing overhead foggers.

### **Bed preparation and planting of gerbera**

The land was brought to fine tilth by ploughing up to 40 cm depth. Well decomposed farm yard manure, sand and coir pith in 2:1:1 proportion was added and thoroughly mixed with soil.

Fumigation was done by using formalin @ 8-10litres per 100 m<sup>2</sup>. Raised beds of 40 cm height, 70 cm width and convenient length were prepared with a walking space of 40 cm in between the beds. Gerbera plants (cv. Madagascar) was planted on beds by adopting a spacing of 30 x 30 cm. Basal dose of FYM @ 30 kg m<sup>2</sup>, single super phosphate (SSP) @ 2.5 kg per 10 m<sup>2</sup> and magnesium sulphate @0.5 kg per 10 m<sup>2</sup> area on beds was applied before planting. After three weeks of planting water soluble fertilizers (NPK) 19:19:19 @ 1g per litre was applied through drip irrigation for first three months of planting. During

flowering (NPK) 20:20:20 + 13:0:45 and water soluble fertilizers like Mono ammonium phosphate, sulphate of potash, potassium nitrate, calcium nitrate were given through fertigation for better flower quality. Need based plant protection measures were taken up to protect the plants from pest and disease incidence. Besides this, different concentrations of nano and conventional micronutrients (Fe and Zn) which includes T<sub>1</sub>- ZnO @ 300 ppm, T<sub>2</sub>- ZnO @ 200 ppm, T<sub>3</sub>- FeO @ 300 ppm, T<sub>4</sub>- FeO @ 200 ppm, T<sub>5</sub>- FeSO<sub>4</sub> @ 0.2%, T<sub>6</sub>- ZnSO<sub>4</sub> @ 0.2%, T<sub>7</sub>- ZnO @ 300 ppm + FeO @ 300 ppm, T<sub>8</sub>- ZnO @ 300 ppm + FeO @ 200 ppm, T<sub>9</sub>- ZnO @ 200 ppm + FeO @ 300 ppm, T<sub>10</sub>- ZnO @ 200 ppm + FeO @ 200 ppm, T<sub>11</sub>- ZnSO<sub>4</sub> @ 0.2% + FeSO<sub>4</sub> @ 0.2%, T<sub>12</sub>- control (Water spray) were applied as a foliar spray at 45 days intervals from 30 days after planting.

The economics of gerbera cultivation in poly house was worked out for one year. Based on the yield data, the gross returns and net returns were calculated for each treatment. The benefit cost ratio (B:C) was determined by dividing the net returns with the total cost of each treatment on hectare bases. Cost of different concentrations of nano and conventional micronutrients was calculated separately with considering total material used.

The cost of cultivation in each treatment was worked out based on the actual expenditure incurred on each item. Only cost of each treatment is changing according to material used for the different treatments others costs are same.

The cost planting material, manures, chemical fertilizers, pesticides, fungicides, labour wages and all the cultural practices including harvesting was worked out based on the prevailing prices and wages during the cropping season and expressed as cost of cultivation per hectare.

$$\text{Depreciation rate (\%)} = \frac{\quad}{100}$$

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Life span of an asset

$$\text{Amount of Depreciation} =$$

Cost of an asset x Depreciation rate

$$\text{-----}$$
$$100$$

### Gross income

The gross income was calculated on the basis of sale price of gerbera stems prevailing during the study period. The total yield of gerbera cut flowers was multiplied with the average price prevailed in the market and expressed as total income per hectare.

### Net income

Gross income minus cost of cultivation in each treatment was recorded as corresponding net income.

### Benefit cost ratio

The ratio of net income to the total cost of cultivation was recorded as benefit - cost ratio. It was computed by dividing the net income by the total cost of cultivation.

$$\text{Benefit cost ratio} =$$

Net returns

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Total cost of cultivation

### Results and Discussion

The details of cost of cultivation, gross and net returns and benefit cost ratio of different treatments were presented in table 1 and 2. Depreciation cost for polyhouse construction, laying of drip and planting material was calculated for one year. There was significant differences among different treatments with respect to B:C ratio.

**Table.1** Cost of cultivation of gerbera under naturally ventilated polyhouse (hectare<sup>-1</sup>) for one year

S.No	Particulars	Details	Price Unit <sup>-1</sup> (Rs.)	Total (Rs.)
<b>A.</b>	<b>Fixed Cost</b>			
1.	Construction of poly house	Top: UV stabilized plastic sheets Side: 70% Agro shade net (life span is 10 years)	Rs. 400 /- per sq. mtr. Depreciation @ 10%	4,00, 000
2.	Micro irrigation system	Drip system for plants, misting system, fertigation unit, water filtration unit (life span is 10 years)	Rs. 25 /- per sq. mtr. Depreciation @ 10 %	25,000
3.	Bed preparation			
	1.FYM	30 kg/ m <sup>2</sup>	Rs. 600 /- per tonne	180,000
	2. coir pith	1 kg/m <sup>2</sup>	Rs. 5,000 /- per tonne	50,000
	3. Basal dose fertilizers	SSP @ 250 g/m <sup>2</sup> MgSO <sub>4</sub> @ 50 g/m <sup>2</sup>	Rs. 9000 /- per tonne Rs. 9000 /- per tonne.	27,000
	4. Formaldehyde	Soil sterilization by formaldehyde @ 7 l/100 sq.m	Rs. 40 /- litre.	28,000
4.	Planting material	Requires 6 plants per m <sup>2</sup> and 60,000 plants per hectare (Duration of plants is 3 years)	Rs. 20/- @ each plant Depreciation @ 33.3 %	3,99,996
<b>B.</b>	<b>Variable cost</b>			
1.	Irrigation charges	Including electricity charges	Rs. 4,000/- per year	4,000
2.	Plant protection chemicals	Includes neem oil, rogor, fipronil, Blitox etc.,	Rs. 0.20/- per plant per month	144,000
3.	Fertilizers cost	Includes calcium nitrate, potassium nitrate, mono ammonium phosphate, sulphate of potash and some micronutrients etc.,	Rs. 0.5/- per plant per month	360,000
4.	Labour cost	8 labours daily for 360 days 2 men and 6 women labour	Men @ 120 per day Women @ 100 per day	302,000
5.	Packing and transportation	This includes plastic sleeves, card board boxes, transport and sales commision etc.,	Rs. 0.20 per flower	6,00,000
	Total			3,320,000

**Table.2** Economics of gerbera cultivation as influenced by nano and conventional micronutrients (Zn and Fe) production

Treatments	Fixed cost (Rupees)	Variable cost (Rupees)	Total cost of cultivation (Rupees)	Flower yield ha <sup>-1</sup> (lakh number)	Gross returns (lakh rupees)	Net returns (lakh rupees)	Benefit cost ratio
<b>T<sub>1</sub>- ZnO @ 300 ppm</b>	1109996.00	1424400.00	2534396	35.07	105.21	79.87	1: 3.15
<b>T<sub>2</sub>- ZnO @ 200 ppm</b>	1109996.00	1419600.00	2529596	32.41	97.23	71.93	1: 2.84
<b>T<sub>3</sub>- FeO @ 300 ppm</b>	1109996.00	1428000.00	2537996	32.90	98.70	73.32	1: 2.89
<b>T<sub>4</sub>- FeO @ 200 ppm</b>	1109996.00	1422000.00	2531996	32.11	96.33	71.01	1: 2.80
<b>T<sub>5</sub>- FeSO<sub>4</sub> @ 0.2%</b>	1109996.00	1417600.00	2527596	27.20	81.60	56.32	1: 2.23
<b>T<sub>6</sub>- ZnSO<sub>4</sub> @ 0.2%</b>	1109996.00	1419600.00	2529596	27.69	83.07	57.77	1: 2.28
<b>T<sub>7</sub>- ZnO @ 300 ppm + FeO @ 300 ppm</b>	1109996.00	1442400.00	2552396	38.40	115.20	89.68	1: 3.51
<b>T<sub>8</sub>- ZnO @ 300 ppm + FeO @ 200 ppm</b>	1109996.00	1436400.00	2546396	39.76	119.28	93.82	1: 3.68
<b>T<sub>9</sub>- ZnO @ 200 ppm + FeO @ 300 ppm</b>	1109996.00	1437600.00	2547596	38.19	114.57	89.09	1: 3.50
<b>T<sub>10</sub>- ZnO @ 200 ppm + FeO @ 200 ppm</b>	1109996.00	1431600.00	2541596	36.17	108.51	83.09	1: 3.27
<b>T<sub>11</sub>- ZnSO<sub>4</sub> @ 0.2% + FeSO<sub>4</sub> @ 0.2%</b>	1109996.00	1427200.00	2537196	30.70	92.10	66.73	1: 2.63
<b>T<sub>12</sub>- control (Water spray)</b>	1109996.00	1410000.00	2519996	23.97	71.91	46.71	1:1.85

\*Cost of each gerbera stem- Rs. 3/-

T<sub>8</sub>- ZnO @ 300 ppm + FeO @ 200 ppm recorded maximum net returns (lakh Rs. 93.82 ha<sup>-1</sup>) with higher B:C ratio (1:3.68) followed by T<sub>7</sub>- ZnO @ 300 ppm + FeO @ 300 ppm (lakh Rs. 89.68 ha<sup>-1</sup>) with B:C ratio (1:3.51) and T<sub>9</sub>- ZnO @ 200 ppm + FeO @ 300 ppm (lakh Rs. 89.09 ha<sup>-1</sup>) with B:C ratio (1:3.50) while T<sub>12</sub>- control recorded minimum net returns (lakh Rs. 46.71 ha<sup>-1</sup>) with lower B:C ratio (1:1.85). Similar trend of results were also obtained by Davarpanah *et al.*, (2013) in pomegranate and Kumar *et al.*, (2017) in strawberry.

Nanotechnology is one of the new technologies recently used in agriculture production. The researchers indicate many of the potential benefits of nanotechnology. Considering the present investigation, it may be concluded that foliar application of ZnO @ 300 ppm and FeO @ 200 ppm was found to be the best in terms of getting maximum benefits through cultivation of gerbera cut flower under naturally ventilated polyhouse.

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