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Effect of Sulphur and Copper Deficiency on Yield and Quality of Gerbera Grown on Cocopeat under Polyhouse Conditions

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Abstract

The results of the experiment revealed that without sulphur and copper treatment showed significant reduction in yield, fresh and drymatter production of gerbera per plant.

Minimum number of flowers were recorded in without copper and without sulphur treatment (2.60 and 2.80 flowers respectively).The significant decrease in fresh weight of roots were recorded under without copper and without sulphur treatment (35.23 g and 35.97 g respectively). The lowest fresh weight of crown + leaves was recorded in without sulphur treatment (91.84 g) followed by without copper treatment (93.99 g). The lowest fresh weight of flower was observed in without copper treatment (62.03 g) followed by without sulphur treatment (68.89 g) as compared to all nutrient treatment (136.18 g). Significantly lowest dry weight of roots was recorded in without copper treatment (5.97 g) followed by without sulphur treatment (6.20 g). Significantly lowest dry weight of crown + leaves was observed in without sulphur treatment (15.99 g) followed by without copper treatment (16.33 g). The lowest dry weight of flower was observed in without copper treatment (10.51 g) followed by without sulphur treatment (11.88 g) as compared to all nutrient treatment (24.41 g).

Key words: Gerbera, sulphur, copper, cocopeat, deficiency, quality

Introduction

Gerbera is an important commercial flower crop grown throughout the world in a wide range of climatic conditions. Gerbera rank 4th among the cut flowers demand (Sujatha[8], *et. al.,* 2002). Maharashtra is one of the pioneer state for protected flower cultivation. In Maharashtra, the area under polyhouse for production was 600 hectares in the year 2010.

Out of that more than 100 hectares area is being adopted for gerbera cultivation with 1476 lakh flowers per year with a productivity of 250 flowers/m^2 (Anonymous[1] 2010). The area under protected gerbera cultivation is mostly confined in Pune, Satara, Kolhapur and Nashik etc. This crop is having lot of scope for export. The success of gerbera cultivation under polyhouse depends largely on nutrient management apart from other factors. There is very little information available about

Table 1: Effect of nutrients on number of flowers per plant, flower stalk length and flower stalk thickness at different days after planting

Treatments	Days after planting					
	115	**130**	**145**	**160**	**175**	**Mean**
A) Number of flowers per plant						
T_1 All nutrients	1	2.33	5.33	6.67	7.33	**4.53**
T_2 Without S	0	2	3.33	4	4.67	**2.8**
T_3 Without Cu	0	2	3	3.67	4.33	**2.6**
Mean	**0.33**	**2.11**	**3.89**	**4.78**	**5.44**	–
	Treatment (T)		**DAP (D)**		**Interaction (T x D)**	
SE ±	0.12		0.16		0.28	
CD at 5%	0.36		0.47		0.81	
Observation at 100 days after planting: 0 (Flowers were not allowed upto 100 days)						
B) Flower stalk length (cm)						
T_1 All nutrients	60.97	62.63	64.1	66.8	68.1	**64.52**
T_2 Without S	0	61.1	60.2	59.37	58.1	**47.75**
T_3 Without Cu	0	61	60	58.33	57.17	**47.3**
Mean	**20.32**	**61.58**	**61.43**	**61.5**	**61.12**	–
	Treatment (T)		**DAP (D)**		**Interaction (T x D)**	
SE ±	0.1		0.13		0.22	
CD at 5%	0.29		0.37		0.65	
Observation at 100 days after planting: 0 (Flowers were not allowed upto 100 days)						
C) Flower stalk thickness (mm)						
T_1 All nutrients	6.4	6.67	7	7.4	7.6	**7.01**
T_2 Without S	0	6.3	6.07	5.96	5.87	**4.84**
T_3 Without Cu	0	6.28	6	5.87	5.73	**4.78**
Mean	**2.13**	**6.42**	**6.36**	**6.41**	**6.4**	–
	Treatment (T)		**DAP (D)**		**Interaction (T x D)**	
SE ±	0.029		0.038		0.066	
CD at 5%	0.085		0.1		0.19	
Observation at 100 days after planting: 0 (Flowers were not allowed upto 100 days)						

correct diagnosis of particular nutrient deficiency in crop plants. The criteria of essentiality given by Arnon and Stout (1939), states that 17 essential nutrient elements required for plant to complete their life cycle. Out of 17 essential elements sulphur and copper are important for plant to complete their life cycle. It is also essential to study the effect of deficient nutrient on movement or accumulation of other nutrients. Gerbera growing farmers facing problems to rectify the deficiency symptoms of various nutrients under polyhouse condition. The success of gerbera cultivation under polyhouse depends largely on nutrient management apart from other factors. Therefore it is necessary to know the effect of sulphur and copper deficiency on yield and dry matter of Gerbera.

Material and Methods

The present investigation on "Diagnosis of sulphur and copper deficiency on gerbera grown on cocopeat under polyhouse conditions" was undertaken during 2013-2014 at the Hi-Tech Floriculture and Vegetable Project, College of Agriculture, Pune on gerbera cv. Goliath in a factorial completely randomized block design with three replications. There were sixteen (15 + 1) treatment combinations with 3 main treatment (Nutrient combination) and 5 subtreatments (harvesting days). Main teratments consist of T_1 treatment combinations were supplied with all nutrients solution, T_2 treatment combinations were supplied with all nutrients without sulphur solution and T_3 treatment combinations were supplied with all nutrients without copper solution. Subtreatments includes harvesting at 115, 130, 145, 160, 175 days after planting. Fertigation through drippers was started after 21 days after planting and this was continued up to 100 days after planting to all plants. All nutrients fertigation was given upto 100 days. There after the treatments were started and fertigation was given through saline bottles @ 500ml per each plant per alternate day as per the treatments. It was carried out by following tank A and tank B stock solutions. Tank "A" for all nutrients, without sulphur, without copper were prepared in 25 litres stock solution and stored in cans, whole tank "B" for all nutrients, without sulphur, without copper were also prepared 25 litres stock solution, it was also stored in cans. Twenty five litres of tank "A" and tank "B" solutions were prepared. The solution was diluted from both the tanks (10 ml from tank A + 10 ml from tank B prepared volume 1 litre adjusted pH 5.0-6.1, EC 1.2-1.4 dSm-1) and 500 ml given per plant /alternate day. The dose of nitrogen 200, phosphorous 60 and potassium 260 mg/plant/alternate day before flowering was applied. After flowering, to meet the demand of the crop the dose was incresed for nitrogen 350, phosphorous 60 and potassium 300 mg/plant/ alternate day. All nutrients were given to plants upto 100 days and treatments were started after 100 days. These fertigations through saline bottles were continued up to 175 days after planting i.e., till the final harvest on every alternate day. Cocopeat used for experimental purpose is acidic in nature (pH 5.70) and having very high water holding capacity (81.0%). It contains all the nutrients in limited quantities but rich in iron. The cocopeat contains 0.61% sulphur and 22.0 mg per kg copper initially. The cocopeat also have high CEC and is responsible for holding the nutrients added in growth media. Amongst the micro nutrients, comparatively higher values of iron than that of zinc, manganese and copper were found in cocopeat. The data recorded was statistically analysed using factorial complete randomized design for each treatment by the methods described by Panse and Sukhatme[6] (1985).

Results and Discussion

The number of flowers, flower stalk length and flower stalk thickness at different days after planting as influenced by with and without sulphur and copper treatments are presented in Table 1.

Number of flowers per plant

Minimum number of flowers were recorded in without copper and without sulphur treatment (2.60 and 2.80 flowers respectively) due to without copper and without sulphur nutrition. It might be due to sulphur has its role in production of starch, sugars, vitamins and other vital compounds through photosynthesis. In without copper it might be due to copper acts as electron carrier in enzymes which bring about oxidation reduction. Maximum number of flowers (4.53 flowers) were recorded under all nutrients treatment due to all nutrients supply. Also maximum no. of flowers (5.44) were recorded at 175 DAP which was significantly superior over 115 (0.33), 130 (2.11), 145 (3.89) and 160 (4.78) days after planting. The interaction was found statistically significant. Minimum number of flowers were recorded under without copper treatment because copper has its role in flowering. The results obtained are in confirmation with earlier results as stated by Ranshur[7] (2009).

Table 2 : Effect of nutrients on flower head diameter, vase life of flower and colour of flower at different days after planting

Treatments	Days after planting					
	115	**130**	**145**	**160**	**175**	**Mean**
A) Flower head diameter (cm)						
T_1 All nutrients	10.6	10.97	11.6	11.7	12.03	**11.38**
T_2 Without S	0	9.6	9.3	9.13	8.87	**7.38**
T_3 Without Cu	0	8.5	7.3	7.23	6.8	**5.97**
Mean	**3.53**	**9.69**	**9.4**	**9.36**	**9.23**	
	Treatment (T)		**DAP (D)**		**Interaction (T x D)**	
SE ±	0.038		0.049		0.086	
CD at 5%	0.11		0.14		0.24	
Observation at 100 days after planting: 0 (Flowers were not allowed upto 100 days)						
B) Vase life of flower (days)						
T_1 All nutrients	12.33	13	14	15	16	**14.07**
T_2 Without S	0	12.67	11.67	10.33	10	**8.93**
T_3 Without Cu	0	11.33	10.67	10	9.67	**8.33**
Mean	**4.11**	**12.33**	**12.11**	**11.78**	**11.89**	
	Treatment (T)		**DAP (D)**		**Interaction (T x D)**	
SE ±	0.13		0.17		0.31	
CD at 5%	0.39		0.51		0.88	
Observation at 100 days after planting : 0 **(**Flowers were not allowed upto 100 days)						

C) Colour of flower

Treatments	Days after planting				
	115	**130**	**145**	**160**	**175**
T_1 All nutrients	Indian orange 713/2	Indian orange 713/2	Indian orange 713/2	Indian orange 713/2	Indian orange 713/2
T_2 Without S	-	Indian orange 713/2	Indian orange 713/2	Nasturtium orange 610	Nasturtium orange 610
T_3 Without Cu	-	Indian orange 713/2	Chinese yellow 606	Chinese yellow 606	Chinese yellow 606

Observation at 100 days after planting: 0 (Flowers were not allowed upto 100 days)

Indicates flowers were not appeared in T_2andT_3treatment upto 115 days

Flower stalk length

Significant decrease in flower stalk length were recorded in without copper and without sulphur treatment (47.30 and 47.75 cm respectively) due to without copper and without sulphur nutrition. Maximum flower stalk length (64.52 cm) was recorded under all nutrients treatment due to all nutrients supply. The interaction was found statistically significant. Minimum flower stalk length were recorded under without copper treatment because copper has its role in flowering and reduced anthocyanin in petals. The results obtained are in confirmation with earlier results as stated by Chaudhary[2] (2006).

Flower stalk thickness

The significant decrease in flower stalk thickness were observed in without copper and without sulphur treatment (4.78 and 4.84 mm respectively) due to without copper and without sulphur nutrition. Maximum flower stalk thickness (7.01 mm) was recorded under all nutrients treatment due to all nutrients supply. The interaction was found to be statistically significant. Minimum flower stalk thickness (4.78 mm) were recorded under without copper treatment because copper has its role in flowering and copper catalyzes several plant processes. The results obtained are in confirmation with earlier results as stated by Fischer[3] (1987) and Chaudhary[2] (2006).

Flower head diameter, vase life of flower and colour of flower at different days after planting as influenced by with and without sulphur and copper treatments are presented in Table 2.

Flower head diameter

The significant decrease in flower head diameter were observed in without copper and without sulphur treatment (5.97 and 7.38 cm respectively) due to without copper and without sulphur nutrition. Maximum flower head diameter (11.38 cm) was recorded under all nutrients treatment due to all nutrients supply. The interaction was found statistically significant. Significantly maximum flower head diameter was recorded at 130 DAP which was significantly superior over 115 (3.53 cm), 145 (9.40 cm), 160 (9.36 cm) and 175 (9.23 cm) days after planting. Minimum flower head diameter (5.97 cm) were recorded under without copper treatment because copper has its role in flowering and might be due to effect of reduction in anthocyanin content in petals. The results obtained for copper are in confirmation with earlier results as stated by Chaudhary[2] (2006) and Ranshur[7] (2009).

Vase life of flower

The significant reduction in vase life of flower were observed in without copper and without sulphur treatment (8.33 and 8.93 days respectively)due to without copper and without sulphur nutrition. The vase life in sulphur was reduced might be due to Sulphur has role in activation of enzymes, which aid in biochemical reactions within the plant. Significantly lowest vase life of flower was recorded in without copper treatment (8.33 days). This might be due to copper having effect on anthocyanin content in petals and senescence. The results obtained for copper are in confirmation with earlier results as stated by Maharana and Pradhan[5] (1977) and Fischer[3] (1987).

Colour of flower

All nutrients treatment showed Indian orange 713/2. The intensity of colour remains same in all nutrient treatment. Where as in without sulphur treatment colour of flower changes from orange to light orange from 155 days onwards upto last harvest i.e. from indian orange (713/2) to nasturtium orange (610). The colour of flower without sulphur treatment remains constant from 155 days to 175 days. Under without copper treatment colour of flower changes from orange to light yellow from 145 days onwards upto last harvest i.e. from Indian orange (713/2) to chinese yellow (606). The colour of flower without copper treatment remains constant from 145 days to 175 days. The results obtained for copper are in confirmation with earlier results as stated by Maharana and Pradhan[5] (1977).

Conclusion

The results of the experiment revealed that without sulphur and copper treatment showed significant reduction in number of flowers, flower stalk length, flower stalk thickness, flower head diameter and vase life of flower. Colour of flower also changed in without sulphur and copper treatment as compared to all nutrients treatment in gerbera plants.

References

1. Anonymous 2010. Marathi booklet on gerbera cultivation under polyhouse. MPKV/ EXTN. PUB. No. 701/ 2010.
2. Chaudhary, R. D. 2006. Studies on NPK Nutrient Requirement and Suitability of Growth Media on Yield and Quality of Gerbera. The thesis of Ph. D. submitted to M. P. K. V., Rahuri.

3. Fischer, P. and Forchthammer, L. 1987. Copper Fertilisation on Gerbera. Deutsher- Gartenbau : 41(11):674-678.
4. Juszczuk, Izabela M., and Monika Ostaszewska.2011. Respiratory activity, energy and redox status in sulphur- deficient bean plants. Poland J.Environ. and Exptl. Bot. 74 : 245– 254.
5. Maharana, T. and Pradhan, R. C. 1977. Effect of micronutrients on growth and flowering of hybrid rose. Orissa J. Hort. 5 : 1-2 and 7-10.
6. Panse, V.G. and Sukhtme, P.V.1985. Statistical methods for agricultural workers. 4th Ed. ICAR, New Delhi. 157-165.
7. Ranshur, N. J. 2009. Assessment of soil growth media and micronutrient cation requirement for gerbera cultivation in Alfisol under polyhouse conditions. Ph.D.Thesis submitted to MPKV Rahuri.
8. Sujatha K., Gowda J.V. and Khan M.M. 2002. Effects of different fertigation levels on gerbera under low cost greenhouse. J. Ornam. Hortic. 5(1):54-59.