Effect of Jeevamrit on growth and flowering of iris (*Iris orientalis* Mill) cv Frigia

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ABSTRACT

The present investigations were carried out to study the effect of Jeevamrit on growth and flowering of iris (*Iris orientalis* Mill) cv Frigia at the research farm of Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during 2019-20 in randomized block design. Sixteen treatments of Jeevamrit were applied both as drench as well as foliar spray at 15 days interval which were replicated thrice. Maximum days taken to visible flower bud formation (113.87 and 113.40), to first flower opening (124.40 and 124.67), number of leaves per plant (10.00 and 10.13), plant height (87.22 and 86.62 cm), spike length (64.57 and 63.90 cm), floret size (13.39 and 13.20 cm), fresh weight of cut stems (40.59 and 40.87 g), vase life (11.53 and 11.40 days) and flower duration (10.17 and 9.83 days) were recorded in the treatments comprising 5.0 per cent Jeevamrit drenching + 10.0 per cent Jeevamrit foliar application and 5.0 per cent Jeevamrit drenching + 15.0 per cent Jeevamrit foliar application respectively, the two treatments being statistically at par and superior to all other treatments. However, the treatment 5.0 per cent Jeevamrit drenching + 10.0 per cent Jeevamrit foliar application resulted in maximum number of florets per spike (3.87) followed by the treatment 5.0 per cent Jeevamrit drenching + 15.0 per cent Jeevamrit foliar application (3.60). In case of stem diameter, the treatments 5.0 per cent Jeevamrit drenching + 10.0 per cent Jeevamrit foliar application, 5.0 per cent Jeevamrit drenching + 15.0 per cent Jeevamrit foliar application and 7.5 per cent Jeevamrit drenching + 5.0 per cent Jeevamrit foliar application resulted in maximum stem diameter of 6.80, 6.73 and 6.64 cm respectively as compared to all other treatments. Thus the application of Jeevamrit as 5.0 per cent drenching along with 10.0 or 15.0 per cent foliar application was proved most effective in enhancing the growth and flowering of iris cv Frigia.

Keywords: Iris; Jeevamrit; drenching; foliar spray; growth; flowering

INTRODUCTION

Iris is a commercial cut flower and a popular garden flower. It is naturally distributed throughout the temperate and sub-tropical zones of the northern hemisphere. The genus *Iris* is the largest in the monocot family Iridaceae and it consists of approximately 300 known species (De and Bhattacharjee 2003). *Iris orientalis* is native to Asia Minor and is commonly known as a yellow banded iris because of its white flowers with a yellow mark or blotch.

The Green Revolution, was a massive shift in agricultural practices that began in the 1940s and found its culmination in the 1960s, by which time techniques such as the application of chemical fertilizers, pesticides, herbicides and fungicides were of industry standard throughout the world. The excessive use of these caused problems of soil degradation, poor quality production, environmental pollution and severe hazards to human health. Inorganic fertilizers application can only supply one or two nutrient elements. On the other hand, organic

farming can be used as an alternative practice (Naeem et al 2006) for soil structure improvement and microbial biomass (Dhull et al 2004). As the cost of inorganic fertilizers is increasing enormously, these are out of the reach of small and marginal farmers. One of the ways by which technology can be made feasible for adoption by economically poor farmers is by adopting zero-budget natural farming (ZBNF). The basic toolkit of ZBNF mainly includes Panchagavya, Beejamrit, Jeevamrit etc which are the fermented products used as plant growth enhancing substances prepared with the material available to farmers.

Jeevamrit is excellent liquid manure containing nitrogen, phosphorus, potassium and many other important essential nutrients. It adds organic matter to the soil which improves soil structure, soil aeration, soil water holding capacity and water infiltration. It is either sprayed or sprinkled on the crop or added to the irrigation tank at regular 15 days interval until the soil is enriched. It is essential to adopt sustainable agricultural practices for different crops based on scientific facts. Keeping this in mind, the present study was planned to produce better quality flowers of iris and work out the effect of soil and foliar application of Jeevamrit on iris.

MATERIAL and METHODS

The present investigations were carried out at the research farm of the Department of Floriculture and Landscape Architecture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during 2019-20. The experiment was laid out in randomized block design with 16 treatment combinations and three replications. Treatments were T_1 (Control, without Jeevamrit), T_2 (2.5% Jeevamrit drenching), T_3 (5.0% Jeevamrit drenching), T_4 (7.5% Jeevamrit drenching), T_5 (5.0% Jeevamrit foliar application), T_6 (10.0% Jeevamrit foliar application), T_7 (15.0% Jeevamrit foliar application), T_8 (2.5% Jeevamrit drenching + 5.0% Jeevamrit foliar application), T_9 (2.5% Jeevamrit drenching + 10.0% Jeevamrit foliar application), T_{10} (2.5% Jeevamrit drenching + 15.0% Jeevamrit foliar application), T_{11} (5.0% Jeevamrit drenching + 5.0% Jeevamrit foliar application), T_{12} (5.0% Jeevamrit drenching + 10.0% Jeevamrit foliar application), T_{13} (5.0% Jeevamrit drenching + 15.0% Jeevamrit foliar application), T_{14} (7.5% Jeevamrit drenching + 5.0% Jeevamrit foliar application), T_{15} (7.5% Jeevamrit drenching + 10.0% Jeevamrit foliar application) and T_{16} (7.5% Jeevamrit drenching + 15.0% Jeevamrit foliar application). Treatment combinations were applied at 15 days interval alternatively under treatments T_8 to T_{16}. The healthy, uniform and disease-free rhizomatous plants were selected for planting.

Preparation of Jeevamrit: Jeevamrit was prepared by dissolving the ingredients as suggested by Sreenivasa et al (2011). It contained cow dung (10 kg), cow urine (10 l), jaggery (2 kg), pulse flour (I kg), a handful of live soil and water (200 l). Five litres of Jeevamrit was mixed in 100 litres of water for preparing 5 per cent foliar spray/drench.

Flow chart of Jeevamrit preparation

Add fresh cow dung + cow urine to water
↓
Mix pulse flour + jaggery and soil in water
↓
Mix the above ingredients and stir properly for 4 days (morning and evening)
↓
On the fifth day, the solution is ready for the soil drenching/spray

All the ingredients were mixed in a plastic drum, covered with a wet jute bag and then kept in shade. It was used as per the treatment schedule.

The statistical analysis for randomized block design was done as suggested by Gomez and Gomez (1984). The level of significance for different variables was tested at 5 per cent value of significance.

RESULTS and DISCUSSION

The data on the effect of Jeevamrit on growth and flowering of iris are given in Table 1.

Days taken to visible flower bud formation: Minimum days to visible flower bud formation (107.53 and 108.13) were recorded without the application of Jeevamrit T_1 (Control) and T_2 (2.5% Jeevamrit drenching) respectively, the two being at par, whereas, maximum days for visible flower bud formation (113.87 and 113.40) were recorded in treatments T_{12} (5.0% Jeevamrit drenching + 10.0 % Jeevamrit foliar application) (113.87) and T_{13} (5.0% Jeevamrit drenching + 15.0% Jeevamrit foliar application)

Table 1. Effect of different Jeevamrit treatments on growth and flowering in Iris cv Frigia

Treatment	Days taken to visible flower bud formation	Days taken to first flower opening	Number of leaves/plant	Plant height (cm)	Spike length (cm)	Number of florets/spike	Floret size (cm)	Stem diameter (mm)	Fresh weight of cut stems (g)	Vase life (days)	Flowering duration (days)
T_1	107.53	118.27	7.47	70.99	49.97	1.27	8.60	5.55	31.79	8.00	7.08
T_2	108.13	119.00	7.93	72.80	52.87	1.53	8.75	5.70	32.81	8.13	7.17
T_3	109.00	119.27	8.20	75.19	54.47	2.00	9.32	5.93	33.70	9.00	7.75
T_4	108.93	119.47	8.27	73.91	53.20	1.80	9.12	5.68	33.34	8.40	7.50
T_5	108.73	119.93	7.80	73.11	53.07	1.53	9.02	5.70	33.11	8.40	7.58
T_6	109.07	120.20	8.13	75.00	54.63	1.93	9.58	5.94	34.01	8.87	7.75
T_7	108.60	119.73	8.13	74.02	53.23	1.60	9.21	5.66	33.04	8.20	7.25
T_8	110.20	121.07	8.73	79.33	56.33	2.20	10.51	6.25	32.98	9.07	7.50
T_9	111.13	122.27	8.80	82.21	58.20	2.27	10.59	6.37	35.46	9.67	8.50
T_{10}	111.60	122.53	8.73	83.11	58.47	2.40	10.83	6.33	36.59	9.87	8.75
T_{11}	112.53	123.60	9.60	85.68	62.80	3.00	12.21	6.51	37.60	10.13	9.08
T_{12}	113.87	124.40	10.00	87.22	64.57	3.87	13.39	6.80	40.59	11.53	10.17
T_{13}	113.40	124.67	10.13	86.62	63.90	3.60	13.20	6.73	40.87	11.40	9.83
T_{14}	112.00	122.93	9.27	84.21	61.07	2.73	12.30	6.64	38.51	10.73	9.25
T_{15}	111.47	122.33	9.13	83.42	60.97	2.67	12.08	6.39	37.59	10.27	9.08
T_{16}	110.27	121.27	8.93	81.35	58.93	2.27	11.29	6.37	37.28	9.67	8.83
$CD_{0.05}$	1.04	1.01	0.20	0.68	1.05	0.20	0.95	0.16	0.88	0.60	0.36

T_1: Control, without Jeevamrit, T_2: 2.5% Jeevamrit drenching, T_3: 5.0% Jeevamrit drenching, T_4: 7.5% Jeevamrit drenching, T_5: 5.0% Jeevamrit foliar application, T_6: 10.0% Jeevamrit foliar application, T_7: 15.0% Jeevamrit foliar application, T_8: 2.5% Jeevamrit drenching + 5.0% Jeevamrit foliar application, T_9: 2.5% Jeevamrit drenching + 10.0% Jeevamrit foliar application, T_{10}: 2.5% Jeevamrit drenching + 15.0% Jeevamrit foliar application, T_{11}: 5.0% Jeevamrit drenching + 5.0% Jeevamrit foliar application, T_{12}: 5.0% Jeevamrit drenching + 10.0% Jeevamrit foliar application, T_{13}: 5.0% Jeevamrit drenching + 15.0% Jeevamrit foliar application, T_{14}: 7.5% Jeevamrit drenching + 5.0% Jeevamrit foliar application, T_{15}: 7.5% Jeevamrit drenching + 10.0% Jeevamrit foliar application, T_{16}: 7.5% Jeevamrit drenching + 15.0% Jeevamrit foliar application

(113.40). Chadha et al (2012) reported that Jeevamrit contains 0.16 per cent nitrogen, 0.02 per cent phosphorus and 0.123 per cent potassium who prepared Jeevamrit solution with the same constituents and method. Therefore, an adequate amount of nitrogen and potash availability to the plants received from Jeevamrit application might have enhanced vegetative growth due to which the reproductive phase initiation was prolonged and there was delay in visible flower bud formation. Also, an increase in nitrogen supply with the application of Jeevamrit might have resulted in vigorous growth of the plants which further delayed the bud formation (Mengel and Kirkby 2001).

Days taken to first flower opening: Earliest first flower opening was recorded in treatments T_1 (118.27 days), T_2 (119.00 days) and T_3 (5.0% Jeevamrit drenching) (119.27 days), which were at par and maximum in T_{13} (124.67 days) and T_{12} (124.40 days), the two being at par. Availability of adequate nitrogen supply to plants by Jeevamrit might have enhanced vegetative growth which prolonged the flower opening. Such delay in flowering with the application of Jeevamrit has also been reported in China aster by Pathania (2019).

Jeevamrit contains major nutrients like nitrogen, phosphorous and potassium (Sreenivasa et al 2011). Nitrogen supply with the application of Jeevamrit might have resulted in stimulating cell division in the meristematic tissue and ultimately enhanced vegetative growth due to which the reproductive phase inhibition was prolonged and delay in days to first flower opening was observed in pot mums (Koppala 2018) and marigold (Singh et al 2015).

Number of leaves per plant: Maximum number of leaves per plant was recorded in treatments T_{13} (10.13) and T_{12} (10.00), the two being at par. In contrast, minimum number of leaves per plant was recorded in T_1 (7.47). This is in confirmation with the findings of Vanlalhruaii (2019) who reported that the supply of Jeevamrit produced maximum number of leaves (frond) in Boston fern.

The application of Jeevamrit results in increase in the microbial population in the soil and the mineralization process which ultimately leads to increased level of available nutrients (Yadav and Mowade 2004). Similar findings were also reported by Kurubetta et al (2017). Nitrogen supply with the application of Jeevamrit might have resulted in stimulating cell division in the meristematic tissue and ultimately increased the leaf emergence in pot mums (Koppala 2018) and marigold (Singh et al 2015).

Plant height: Plant height differed significantly with different doses of Jeevamrit. Maximum plant height was observed in T_{12} (87.22 cm) and T_{13} (86.62 cm), which were at par and minimum in T_1 (70.99 cm). Jeevamrit acts as a growth promoter as it contains macro and micronutrients which are the important constituents of nucleic acid and increase the synthesis of carbohydrates and amino acids etc from which the phytohormones (auxins, gibberellins and cytokinins) have been synthesized (Vemaraju 2014). Jeevamrit also contains consortia of beneficial microbes, resulting in adequate vegetative growth which ultimately increases the plant height (Harshavardhan et al 2016, Aulakh et al 2013, Sreenivasa et al 2009).

Spike length: The maximum spike length was recorded in treatments T_{12} (64.57 cm) and T_{13} (63.90 cm), the two being at par. Minimum spike length was noticed in T_1 (49.97 cm). Jeevamrit contains essential amino acids, vitamins, growth-promoting substances like gibberellic acid (GA_3), indole acetic acid (IAA) and beneficial microorganisms (Gore and Sreenivasa 2011). An increase in spike length might be attributed to better uptake of macro and micronutrients by the plant. Nitrogen is a constituent of chlorophyll, which ascertains increased photosynthates synthesis leading to better vigor. Phosphorus being an essential constituent of cellular protein and nucleic acid might have encouraged the meristematic activity of plants and might have increased the spike length. Potassium is an activator of enzymes involved in protein and carbohydrate metabolism. Thus improved health and vigor of plants enable them to withstand adverse climatic conditions. Similar observations were made by George (2012) in gerbera cv Galileo Red, Singh et al (2015) in marigold, Harshavardhan et al (2016) in carnation cv Big Mama, Singh (2018) in gerbera and Pathania (2019) in China aster.

Number of florets per spike: Maximum numbers of florets per spike (3.87) was observed in T_{12} followed by T_{13} (3.60) and minimum in T_1 (1.27). The reason behind this could be better leaf growth that might have accelerated the photosynthesis during the vegetative phase and further translocation of photosynthates for various metabolic activities during the reproductive phase which, in turn, might have been responsible for the improvement in the number of florets per spike

(Ahmed et al 2010, Roychowdhury 1989). The beneficial effect of Jeevamrit has been attributed to a huge quantity of microbial load and growth hormones enhancing the soil biomass sustaining the availability and uptake of applied as well as native soil nutrients which results in an increased number of florets per spike (Devakumar et al 2014).

Floret size: Maximum floret size was recorded in T_{12} (13.39 cm) and T_{13} (13.20 cm), which were at par. Minimum floret size of 8.60, 8.75, 9.02, 9.12, 9.21 and 9.32 cm was recorded in treatments T_1, T_2, T_5 (5.0% Jeevamrit foliar application), T_4 (7.5% Jeevamrit drenching), T_7 (15.0% Jeevamrit foliar application) and T_3 respectively, all being at par. The probable reason for increase in floret size by Jeevamrit application may be attributed to the enhancement of the activities of microbes by solubilization and uptake of nutrients. In addition to NPK availability in Jeevamrit, GA_3 and IAA are also present in it which might have helped in improving the floret size. The beneficial results of Jeevamrit are also opined by Aulakh et al (2013), Sreenivasa et al (2009) and Devakumar et al (2014). More leaves positively correlate with photosynthetic area which directly increases the food reserve and ultimately leads to better quality floret production.

Stem diameter: Maximum stem diameter was recorded in treatments T_{12} (6.80 mm), T_{13} (6.73 mm) and T_{14} (7.5% Jeevamrit drenching + 5.0% Jeevamrit foliar application) (6.64 mm), the three being at par. Minimum stem diameter was recorded in T_1 (5.55 mm), T_7 (5.66 mm), T_4 (5.68 mm), T_2 (5.70 mm) and T_5 (5.70 mm), all being at par. An increase in stem diameter can be ascribed to the fact that nutrients available in Jeevamrit act as strong promoters of growth. Nitrogen is an important constituent of proteins, nucleic acid and nucleotides which are essential for the different metabolic functions of plants. Phosphorus on the other hand is an important structural component of phospholipids helping in the absorbing and translocation of food material which significantly increase root geometry, nutrient access and supply resulting in the development of healthy stem as reported by Renukaradya et al (2011) in carnation, Koppala (2018) in pot mums and Singh et al (2015) in marigold.

Fresh weight of cut stems: The heaviest weight of cut stems was recorded with treatment T_{13} (40.87 g) and T_{12} (40.59), the two being at par and the minimum (31.79 g) was observed in T_1. The possible role of Jeevamrit in fixing atmospheric nitrogen, increasing available phosphorous and its higher uptake, better root proliferation and vis a vis uptake of nutrients might have resulted in increase in the weight of cut stems. The other possible reason might be that vigorous vegetative growth of the plants due to more photosynthesis and food accumulation ultimately increased the fresh weight of the cut stem. These results are also corroborated by the findings of Manjunatha et al (2009) in sunflower, Deshmukh et al (2010) in ashwagandha, Sushma et al (2012) in heliconia, Singh (2018) in gerbera and Pathania (2019) in China aster.

Vase life: Maximum vase life was registered with treatment T_{12} (11.53 days) and T_{13} (11.40 days), the two being at par. Minimum vase life was recorded in T_1 (8.00 days), T_2 (8.13 days), T_7 (8.20 days), T_4 (8.40 days) and T_5 (8.40 days), all being at par. Increase in the vase life due to application of Jeevamrit might be due to the availability of better food reserves, nutrients and growth promoting substances (gibberlic acid and indole acetic acid) through Jeevamrit for a longer time (Gore and Sreenivasa 2011). These results are in line with the findings of Singh (2018) in gerbera and Vanlalhruaii (2019) in Boston fern.

Flowering duration: Maximum flowering duration was recorded in treatments T_{12} (10.17 days) and T_{13} (9.83 days), which were at par and minimum in T_1 (7.08 days), T_2 (7.17 days) and T_7 (7.25 days), all the three being at par. The supply of nutrients and other growth promoting substances like cytokinins present in Jeevamrit might be responsible for a longer duration of flowering. Almost similar results were reported by Singh (2018) in gerbera and Vanlalhruaii (2019) in Boston fern.

CONCLUSION

It can be concluded that the treatments comprising 5.0 per cent Jeevamrit drenching + 10.0 per cent Jeevamrit foliar application and 5.0 per cent Jeevamrit drenching + 15.0 per cent Jeevamrit foliar application resulted in maximum days taken to visible flower bud formation and first flower opening, number of leaves per plant, plant height, spike length, floret size, fresh weight of cut stems, vase life and flower duration, the two treatments being statistically at par and superior to all other treatments. However, the treatment 5.0 per cent Jeevamrit drenching + 10.0 per cent Jeevamrit foliar application resulted in maximum number of florets per spike followed by the treatment

5.0 per cent Jeevamrit drenching + 15.0 per cent Jeevamrit foliar application. In case of stem diameter, the treatments 5.0 per cent Jeevamrit drenching + 10.0 per cent Jeevamrit foliar application, 5.0 per cent Jeevamrit drenching + 15.0 per cent Jeevamrit foliar application and 7.5 per cent Jeevamrit drenching + 5.0 per cent Jeevamrit foliar application resulted in maximum stem diameter as compared to all other treatments. Thus the application of Jeevamrit as 5.0 per cent drenching along with 10.0 or 15.0 per cent foliar application was proved most effective in enhancing the growth and flowering of iris cv Frigia under mid-hill conditions of Himachal Pradesh.

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