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Influence of biostimulants on growth and yield of floribunda rose cv. Mirabel

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Abstract
The present investigation was undertaken to study the effect of biostimulants on growth and yield of Floribunda rose cv. Mirabel. The biostimulants *viz*., Panchagavya, Jeevamrutha, Amruthpani, Cowurine, Humic acid and Biovita were sprayed at different concentration at monthly intervals (30, 60, 90, 120, 150 and 180 Days after planting respectively). Among different biostimulants, foliar application of T_{14} (50% RDF + Panchagavya @ 2% + Jeevamrutha @ 400 liter /ha + Humic acid @ 2% + Biovita @ 2% + Cowurine @ 20%) recorded significantly maximum plant height (82.25 cm), number of primary branches (6.03), number of secondary branches (22), plant spread in East-West direction (81.45 cm), plant spread in North-South direction (82.44 cm) stem girth (19.77 mm), leaf area (839.37 cm^2) number of flowers per plant (58.60) and cumulative flower yield per plant (427.44 g) at 180 DAP as compared to control. This study indicated that foliar application of T_{14} exhibited superior for growth and yield parameters of Floribunda *cv.* Mirabel.

Keywords: floribunda, mirabel, biostimulants, jeevamrutha and panchagavya

Introduction
Rose is one of the natures beautiful creations and the world's oldest most popular flower, having attractive colours, fragrance and elegance of forms. Rose (*Rosa indica* L.) having chromosome number of 2n=14; belongs to the family Rosaceae. The Rose is native to temperate regions of Northern Hemisphere. The genus *Rosa* contains about 150 known species; among that only seven have contributed to the development of modern cultivars. Rose remains a major ornamental plant for cut flower. It is universally claimed as the "Queen of Flowers" because of its beauty, elegance and symbol of love.

India has an ancient heritage with regard to floriculture which has emerged as a viable option in agri-business and has captured the interest of many new entrepreneurs in floriculture sector. In India, total flowers occupied 307.26 ('000 ha) area and produced 2893.13 ('000 MT) total flowers with productivity of 8.6 MT/ha and loose flower production from an area of 301 ('000 ha) was 1760 ('000 MT) with productivity 5.8MT/ha (Anonymous, 2018) [1]. Rose contributed 29.57 ('000 ha) area and produced 111.74 ('000 MT) loose flowers, 172.29 ('000 Lakh no.) cut flowers (Anonymous, 2018) [1]. The growth of floriculture industry over year 2015-2016 is 11.4 per cent in area and 2.9 per cent in production. Large area is covered under rose cut flower production in Delhi of Northern India and produce cut flowers during winter months from November to March. In South India, production of rose cut flower and loose flower is extensive for domestic purpose.

Floribunda rose involves many cultivars like Iceberg, Charisma, Arthur bell, Sunsprite, Julia child, Mirabel, Amber queen etc. Among these cultivars Mirabel is an attractive red colour variety with early flowering habit, dwarf growth nature and wider adoptability character. It can produce number of loose flowers with lesser pruning practices. Presently there is more demand for Mirabel loose flowers in the domestic market. It's also used as bedding plants, shrubbery, in public parks and landscaping.

Plant biostimulants are referred as "any substances or microorganisms, in the form in which it is applied to plants, seeds or the root environment with the intension to stimulate natural processes of plants benefiting nutrient use efficiency and tolerance to abiotic stress (Jardin *et al*., 2015) [9]. Bioformulations *viz*., Panchagavya, Amruthapani and Agnihothra ash have the potential to play the role of promoting growth and providing immunity in plant system. This improves the efficiency of plant's metabolism to increase yield, enhances the crop quality, tolerance to abiotic stresses and facilitates nutrient assimilation, increases sugar content, flower colour, soil texture, soil structure and water use efficiency (Pamela *et al*., 2014) [15]. The studies related to application of biostimulants on floribunda rose are meager in number.

Therefore, the present experiment was carried out to study the effect of biostimulants on growth and yield of Floribunda rose cv. Mirabel.

Material and Methods

The present investigation on "Effect of biostimulants on floribunda rose *cv*. Mirabel", was carried out at the Horticultural Research and Extension Station, Hidkal Dam, (University of Horticultural Sciences, Bagalkot), Tq. Hukkeri, Dist. Belagavi, Karnataka, during November 2019 to May 2020. The experiment was laid out in a Randomized Block Design (RBD) with 15 treatments T_1- 50% RDF + Panchagavya (1%), T_2- 50% RDF + Panchagavya (2%), T_3- 50% RDF + Jeevamrutha (200 litres /ha), T_4- 50% RDF + Jeevamrutha (400 litres /ha), T_5- 50% RDF + Amruthpani (5%), T_6- 50% RDF + Amruthpani (10%), T_7- 50% RDF + Humic acid (1%), T_8- 50% RDF + Humic acid (2%), T_9- 50% RDF + Biovita (1%), T_{10}- 50% RDF + Biovita (2%), T_{11}- 50% RDF + Cow urine (5%), T_{12}- 50% RDF + Cow urine (10%), T_{13}- 50% RDF + T_1+ T_3+ T_7+ T_9+ T_{11}, T_{14}- 50% RDF + T_2+ T_4+ T_8+ T_{10}+ T_{12}, T_{15}- Control (100% RDF) and 2 replications. Each replication had 20 plants and these plants were selected for recording biometric observations till harvest. The observations like plant height, number of primary and secondary branches, plant spread in East-West and North- South direction, stem girth, leaf area, number of flowers per plant and cumulative flower yield per plant were recorded during the experiment.

Preparation of Amruthpani

Amruthpani was prepared by using 10 kg of cow dung with 250 g of cow ghee were mixed properly and 500 g of honey was added and mixed thoroughly. This mixture was kept for incubation for 24 hours before use (Pathak and Ram, 2004) [17].

Preparation of Panchagavya

It was prepared by usingcow dung **(**7kg) and cow ghee (1kg) were mixed thoroughly and incubated for two days. On the third day, 3 litres of cow urine and 10 litres of water were added to the above mixture and kept for incubation for another 15 days. After incubation, 3 litres of sugar cane juice, 2 litres of cow milk, 2 litres of cow curd, 3 litres of tender coconut water and 12 ripe bananas were added and mixed thoroughly. This mixture was finally kept 15 days for incubation and used (Pathak and Ram, 2004) [17].

Preparation of Jeevamrutha

Jeevamrutha containing 10 kg of cow dung, 10 litres of cow urine, 2 kg local jaggery, 2 kg pulse flour and hand full garden soil were mixed properly. This mixture was kept for seven days for incubation and used (Pathak and Ram, 2004) [17].

Other Bioformulations

Biovita and Humic acid are the prepared biostimulants in which, Biovita was procured from Channakeshava fertilizers, Hassan district and Humic acid was collected from KRCCH, Arabhavi.

Results and Discussion

Plant height (cm)

The plant height was maximum at 180 DAP in T_{14} (Panchagavya @ 2% + Jeevamrutha @ 400 liters / ha + Humic acid @ 2% + Biovita @ 2% + Cow urine @ 10%) 82.25cm, as compared to all other treatments. Increased plant height observed here may be attributed to balanced application of nutrients through RDF and biostimulants which might have created a microclimate condition for root growth and proliferation and absorption of more nutrients from soil. Which might had led to proper cell division and higher meristematic activity resulting in better plant height. Apart from the above Panchagavya and Jeevamrutha are also known to posses phytohormones like IAA, GA and cytokinins. GA induces both cell elongation and division that dramatically stimulates internodes elongation and resulted increase in plant height. The enhanced growth parameters observed here can be attributed to the synergistic effects of Panchagavya and Jeevamrutha. These findings were similar with the results of Chaitra and Patil (2007) [4] in china aster, and Pansuriya *et al*. (2018) [16] in gladiolus (Fig.1)

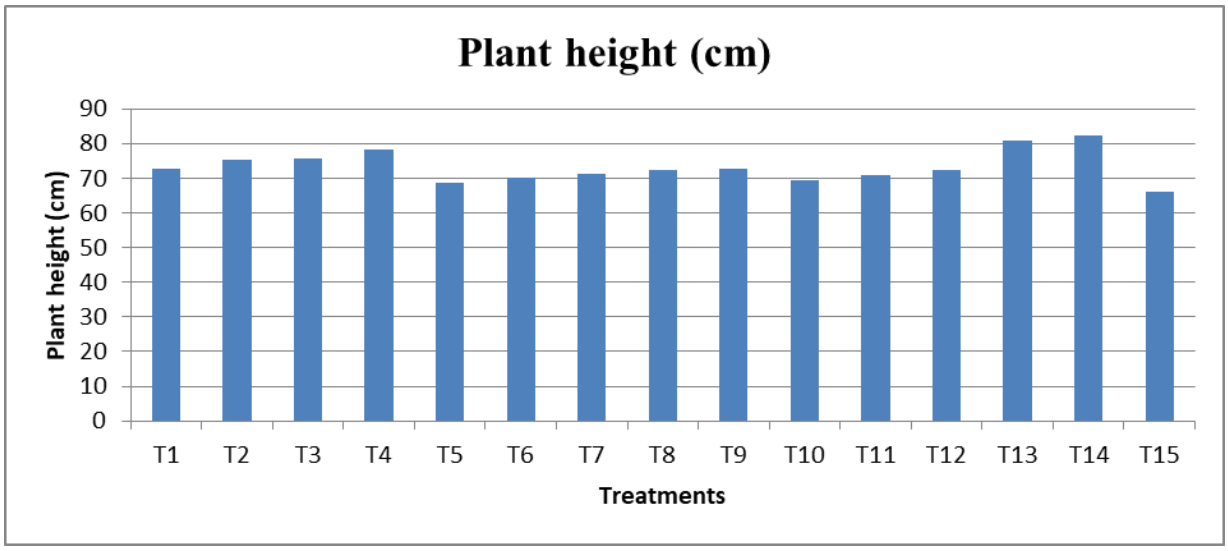

Fig 1: Plant height as influenced by the application of biostimulants in Floribunda rose cv. Mirabel

Number of primary branches per plant

Treatment T_{14} (Panchagavya @ 2% + Jeevamrutha @ 400 liters / ha + Humic acid @ 2% + Biovita @ 2% + Cow urine @ 10%) recorded the highest (6.03) number of primary branches at 180 DAP (fig 2). The application of various biostimulants leads to easy uptake of macro and

micronutrients along with plant growth substances into the plant system, which helps in better vegetative growth of the plant (Bohra *et al*., 2019) [2]. Presence of cytokinin and GA_3 in panchagavya might have resulted in breakage of apical dominance and promoted higher number of branches. These results are supported by the findings Pruthvi *et al.* (2017) [19] and Bhargavi *et al.* (2018) [3] in chrysanthemum.

Number of secondary branches per plant

At 180 DAP, higher number of secondary branches were recorded in T_{14} (Panchagavya @ 2% + Jeevamrutha @ 400 liters / ha + Humic acid @ 2% + Biovita @ 2% + Cow urine @ 10%) (Table 1). Panchagavya is known to contain growth regulatory substances such as IAA, GA and cytokinin, essential plant nutrients, naturally occurring beneficial effective microorganisms (EMO's) and proven biofertilizers such as, *Acetobacter*, *Azospirillum* and *Phosphobacterium* and plant protection substances. Presence of cytokininin Panchagavya might have increased cell division and cell elongation which induces more number of shoots in plants (Somasundaram *et al.*, 2004) [20]. The findings are in accordance with the results obtained by Pruthvi *et al.* (2017) [19] and Bhargavi *et al.* (2018) [3] in chrysanthemum.

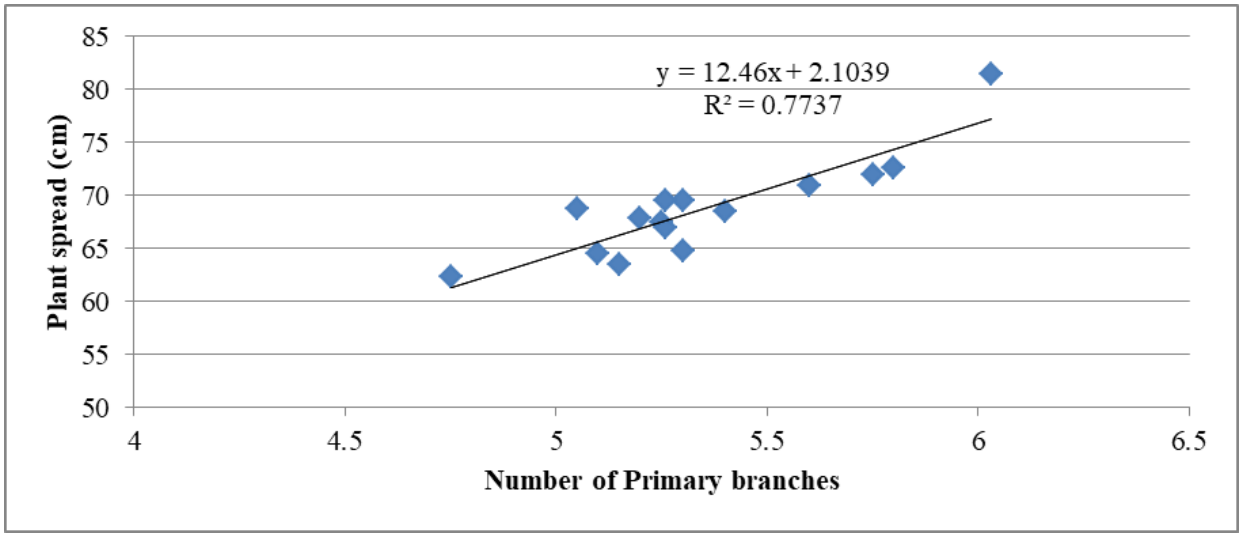

Fig 2: Influence of number of primary branches on plant spread in Floribunda rose cv. Mirabel

Plant spread in Eas-West and North –South direction

There was no much variation with respect to the plant spread East to West and North to South direction upto 90 days. Highest plant spread (East to West) at 90, 120, 150 and 180 DAP was noticed in T_{14} (Panchagavya 2% + Jeevamrutha 400 litres / ha + Humic acid 2% + Biovita 2% + Cow urine 10%) (57.61, 70.55, 76.46 and 81.45 cm, respectively) and Higher plant spread (North to South) at 90, 120, 150 and 180 DAP was observed in T_{14} (57.61, 70.55, 76.46 and 81.45 cm respectively) as compared to all other treatments. Foliar application of biostimulants may have helped in better absorption of Nitrogen leading to increased number of leaves through photosynthesis process (Somasundaram *et al*., 2004) [20]. Presence of growth regulatory substances such as IAA, GA and cytokinin in Panchagavya might had increased the number of secondary branches. Both increase in leaf area and number of secondary branches may contribute to increase in plant spread in East-West and North-South direction. Presence of maximum number of primary and secondary branches had increased the plant spread in both direction (Table 1, Fig. 2). These results are corroborated with the findings of Vijayananthan *et al.* (2007) [21] in jasmine and Gaurav *et al.* (2016) [6] in African marigold.

Stem girth

Treatment T_{14} (Panchagavya @ 2% + Jeevamrutha @ 400 liters / ha + Humic acid @ 2% + Biovita @ 2% + Cow urine @ 10%) showed highest (19.77 mm) stem girth at 180 DAP. This might be due to the fact that the combined effect of humic acid and panchagavya are helpful in producing more vigorous growth of the plant and secondary growth characterized by an increase in stem thickness. These findings are in close proximity with the reports of Pruthvi *et al.* (2017) [19] and Bhargavi *et al.* (2018) [3] in chrysanthemum and Pansuriya *et al.* (2018) [16] in gladiolus.

Leaf area

There was a major variation with respect to the leaf area among the treatments. The maximum leaf area per plant (839.37 cm^2) was noticed in T_{14} (Panchagavya 2% + Jeevamrutha 400 litres / ha + Humic acid 2% + Biovita 2% + Cow urine 10%) at 180 DAP (Fig. 3). The increase in leaf area could be due to the effective components of seaweed extract such as major and minor elements, growth regulator and vitamins which might have enhanced the cell division metabolism and other biological reactions. Presence of nitrogen content in Cow urine and Panchagavya could have helped the plant to produce more chlorophyll, which especially promotes shiny, healthy and darker colored leaves. These results are corroborated with the findings of Isaac (2007) [8] in gladiolus and Palanisamy *et al.* (2015) [13] in gerbera.

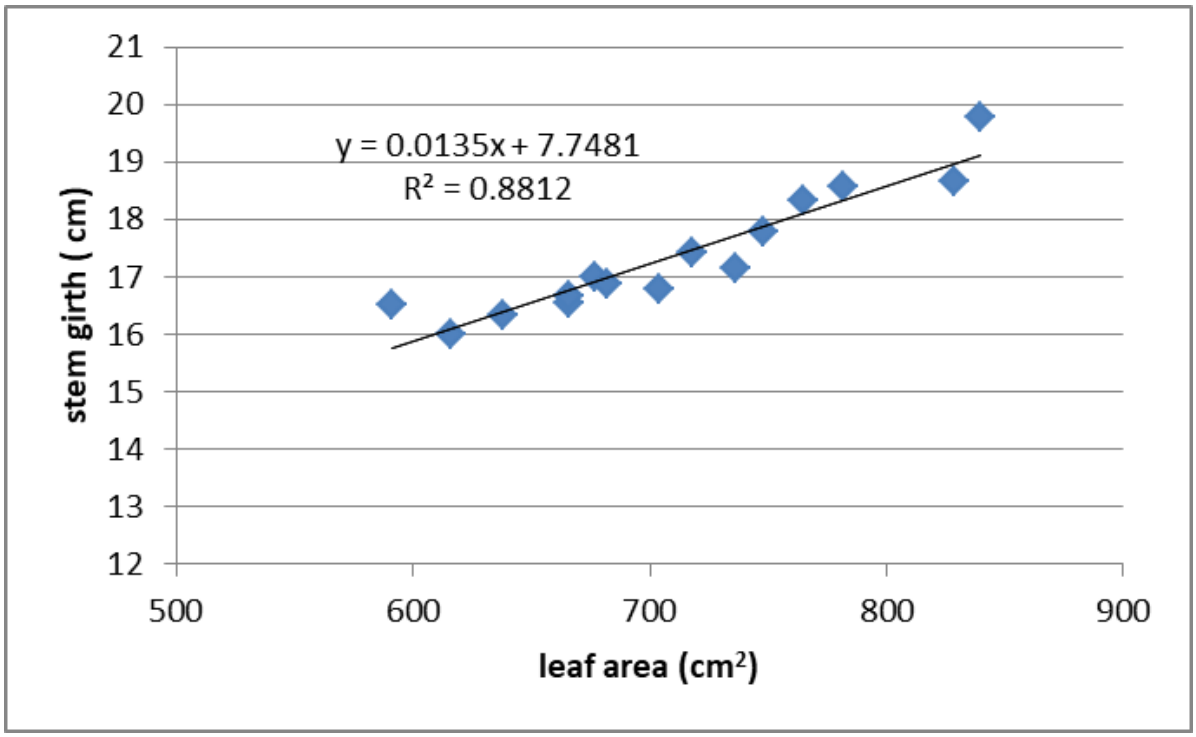

Fig 3: Influence of leaf area on stem girth of plant in Floribunda rose cv. Mirabel

Number of flowers per plant

Highest number of flowers per plant (58.60) at 180 DAP was recorded in the treatment T_{14} (Panchagavya @ 2% + Jeevamrutha @ 400 liters / ha + Humic acid @ 2% + Biovita @ 2% + Cow urine @ 10%) (Table 1).The increase in flower number might be due to application of seaweed extract, which might have produced significant increase in vegetative growth which in turn produced the more photosynthates which were probably diverted towards the more flower production in plants. In Panchagavya transportation of growth promoting substances like cytokinin to axillary buds, resulting in breakage of apical dominance which has resulted in better sink for faster mobilization of photosyntates and early transformation of plant from vegetative to reproductive phase. The increase in phosphorous is found to be involved in the flower initiation leading to increase in number of flowers in gladiolus (Pansuriya *et al*., 2018) [16]. The similar results were also observed by Mahawer *et al*. (2010) [12] in tuberose and Harshavardhan *et al.* (2014) [7] in carnation.

T_{14} – Best treatment

T_{15} – Control

Cumulative flower yield per plant

The highest cumulative flower yield per plant at180 DAP was recorded in the T_{14} (Panchagavya @ 2% + Jeevamrutha @ 400 liters / ha + Humic acid @ 2% + Biovita @ 2% + Cow urine @ 10%) (427.44 g) (Table 2). Increase in yield as compared to other treatments is mainly due to availability of more nutrients like Nitrogen and Phosphorous from the Biovita, which is responsible for the production of more number of primary and secondary branches, plant spread in both direction, leaf area and higher photosynthesis, which subsequently led to the optimum C:N ratio in the soil (Prutvi *et al*., 2016). Presence of Humic acid might have increased the permeability of plant membranes resulting in higher metabolic activity and improved physical properties of soil, it is also known to promote good soil structure and moisture retention, thereby increases the nutrient uptake of plants (Piccolo *et al*., 1993) [18]. Existence of naturally occurring beneficial microorganism's predominantly nitrogen fixers, phosphorus solublisers, photosynthetic bacteria, lactic acid

bacteria, yeast, actinomycets and fungi in panchagavya, might have supported the plant to absorb more macro and micronutrients quickly from the soil (Devakumar *et al*., 2014) [5]. Jeevamrutha was the source of natural carbon, biomass, nitrogen, phosphorous, potassium and lot of other micronutrients required for the crops and it also contained heavy microbial load (Palekar, 2006) [14]. Due to active and rapid multiplication of bacteria, especially in the rhizosphere, creating favourable conditions for nitrogen fixation and phosphorus solubilisation at higher rates and making it available to the plants leading to more uptakes of nutrients and water. This in turn increases photosynthesis and enhances food accumulation and also diversion of photosynthates towards sinks resulting in better growth and subsequently higher number of flower. The combined application of all these biostimulants with 50% RDF had increased cumulative flower yield per plant. These results were also supported by Khandelwal *et al*. (2003) [11] in marigold and Karthiraj *et al*. (2008) [10] in china aster.

Conclusion

On the basis of the result obtained in the present investigation it is concluded that,the treatment T_{14} proved significant for improving the plant growth, flowering, flower yield and quality of rose. Present study also confirmed that, the use of bio-stimulant is an eco-friendly technique to enhance crop production. Thus, it might be recommended that the rose plants can be sprayed with jeevamrutha, panchagavya, biovita, humic acid and cow urine combindly to get luxurious growth of plant, flowering, flower yield and quality which may ensure us to get maximum net returns.

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