Int.J.Curr.Microbiol.App.Sci (2018) *7*(1): 2125-2130

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 01 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.701.256

Effect of Plant Growth Regulators on Growth and Flowering of Pansy (*Viola x wittrockiana* Gams.) under West Bengal Condition

Ayandip Biswas[1*], Tapas Mandal[1], Srabani Das[2] and Bipra Thakur[1]

[1]Department of Floriculture and Landscape Architecture, B.C.K.V., Mohanpur, Nadia, W.B., India
[2]SBKVK, Kapgari, Jhargarm, W.B., India

**Corresponding author*

Keywords

Plant growth, Flowering, Field, Ground cover

Article Info

Accepted:
16 December 2017
Available Online:
10 January 2018

A B S T R A C T

A field experiment was carried out to observe the effect of plant growth regulators on growth and flowering of pansy (*Viola x wittrockiana* Gams.), a beautiful winter annual suitable for bedding, ground cover and potted plant. Experimental site have subtropical humid climate and sandy loam soil with medium fertility status. Seedlings were planted in raised bed with randomised block design and grown carefully. Plants were treated with foliar application of paclobutrazol, cycocel, ethrel and GA_3. Each chemical consists of two different doses making total eight treatments and control. Records were collected on vegetative and flowering parameters. Data were analysed and results were shown on ANOVA table. Observation from the results reveals that individual growth regulator showed partial beneficial effect on all the plant character studied in plains of West Bengal. Efficacy of cycocel to the highest degree on plant height might be due to the varied mode of action when applied in different concentration. Paclobutrazol reduced the height by blocking multiple steps in biosynthesis of gibberellins and steroids. Significant variation in number of primary branches and flower diameter occur with GA_3 and it is one of the important growth promoting chemical which helps in cell division and cell elongation. However, from the whole course study it can be concluded that under the West Bengal agro climate, $GA_3$and paclobutrazol cited best in regulating plant phenotypic expression, as paclobutrazol kept plant height short and GA_3 increased flower diameter per plant maintaining higher bloom quality.

Introduction

The history of the modern pansy (*Viola x wittrockiana* Gams.) begins with a small European wildflower, *Viola tricolor*, commonly known as Johnny-jump-up (Nau, 1990) hybridized with other viola species. These hybrids are referred to as *Viola* × *wittrockiana* or less commonly *Viola tricolor hortensis.* The garden pansy, *Viola*× *wittrockiana*, is a cool season annual or a short-lived perennial garden flower (Laffe and Styer, 1990). They thrive well in sunny or partial sunlight and it needs to be cultivated in well drained soils. Light levels should be at 2,000 foot candles (Williams, 1990). Plants are low growing, trailing and bushy, compact, herbaceous, and about 15-22 cm in height.

Leaves are dark green, rounded or long, heart shaped with cut edges. Flowers are produced in great profusions, singly on stalks. Flower size varies from 10-12 cm across. Pansies grow best in full sun although they will tolerate shady conditions better than other sun seeking annuals (Carlson, 1989). Flowers are butterfly like, available in almost all shades of colors, ranging from white, red, deep violet, blue, yellow to self coloured and blotched or marked, variegated in magnificent contrasting colors. Excessive elongation and imperfect size of flower is a problem in pansy (Sawaya, 1989). Control of bedding plant growth with chemical growth regulators is a common practice. With the advancement of agriculture in general and horticulture in particular, growth regulator is a popular term which promotes, inhibits or otherwise modify any plant physiological process. Since very limited work has been done in this respect or chapter, an investigation is undertaken to study the effect of Cycocel, GA_3,Ethrel and Paclobutrazol (Latimer and Whipker, 2004) on growth and flowering of pansy (*Viola* × *wittrockiana* Gams.) cv. Super Majestic Giant under open field in raised beds.

Materials and Methods

The experiment was carried out at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India. The site comes under subtropical humid climate with sandy, well drained with medium fertile soil. Seedlings of variety Super Majestic Giant were planted in 1m x 1m raised bed with randomized block design in three replications. Irrigation, weeding and fertilizer application was maintained as described by Carlson (1989). Eight treatments of four plant growth regulators with two doses of each were Paclobutrazol 2.5 ppm (T_1), Paclobutrazol 5 ppm (T_2), Cycocel 250 ppm (T_3), Cycocel 500 ppm (T_4), Ethrel 40 ppm (T_5), Ethrel 80 ppm (T_6), GA_3 50 ppm (T_7), GA_3 100 ppm (T_8) and control (T_9) were without any treatment. Records were collected on vegetative and flowering parameters. Recorded data were analyzed following the procedure described by Panse and Sukhatme (1995).

Results and Discussion

The experimental results obtained and relevant discussion is presented under the following heads:

Vegetative attributes

Plant height in cm (P_1)

Spraying of plant growth regulating chemicals on pansy had shown the significant effect. Table 1 showed that treatment T_3 (9.40) had maximum plant height followed by T_4 (9.20) and T_6 (8.43) with T_2 showing lowest value (6.60). The result reflected the efficacy of cycocel to the highest degree might be due to its mode of action. Cycocel is one of the chemical used to inhibit plant growth either by inhibiting translocation of gibberellins or by promoting their degradation but have various effect on plant growth in different concentration. Baerve (1992) found that plant quality increased when used in low concentration.

On the other hand, paclobutrazol reduced the height by blocking multiple steps in biosynthesis of gibberellins and steroids. Similar result was found by Currey *et al.*, (2010) and Magnitskiy *et al.*, (2006).

Number of mature leaves per plant (P_2)

Spraying of plant growth regulating chemicals on pansy showed significant effect in controlling number of mature leaves per plant. As per Table 1, maximum number of leaves was recorded with T_4 (10.07) which is

statistically at par with T_7 (9.80), T_6 (9.50), T_2 (9.13) and T_3 (8.97) and the lowest value observed with T_8 (8.20). Based on the result obtained from the observation cycocel showed highest number of leaf per plant. Cycocel increased plant height that we discussed earlier. Therefore, it may be directly related with plant height to produce maximum number of leaves. Here, paclobutrazol had no significant effect on number of leaves per plant. It was supported by the findings observed by Lee and Lee (1990) on gerbera.

Number of primary branches per plant (P_3)

Spraying of plant growth regulating chemicals on pansy had shown significant effect in controlling the primary branches per plant under all the treatments. Data presented in Table 1 showed that highest number of primary branches per plant was recorded under the treatment T_8 (3.30) followed by T_6 (3.16), T_5 (3.12), T_3 (3.02), T_7 (2.85) and T_4 (2.75). It is obvious that GA_3 promoted biosynthesis or encouraged the activity of other growth promoting chemicals leading to significant variation in number of primary branches. The result was supported by earlier findings of Shawareb (1987) on chrysanthemum, Bhattacharjee and Singh (1995) on rose cultivar 'Rakthagandha' and Singh (2003) on *Calendula officinalis*.

Number of tertiary branches per plant (P_4)

There is no significant variation in number of tertiary branches per plant (Table 1) due to application of growth regulating chemicals. However, maximum number (2.17) of tertiary branches was observed with control (T_9) treatment which was almost similar to other treatments too. It may happen due to weather condition, varietal character or other physiological process.

Leaf area in sq cm (P_5)

The observation (Table 1) showed significant variation in leaf area of pansy. Highest value recorded with T_6 (24.90) which is statistically at par with T_9 (22.80), T_5 (22.13), T_7 (21.03) and T_8 (20.13). Lowest leaf area was recorded with T_2 (16.30). Therefore, ethrel increased leaf area significantly. It may be due to its mode of action or due to plant physiological process. The result is in similar line with the findings of ElSallami (1996) where successive increase in ethrel concentration showed increasing carbohydrate content of pansy leaf rendering increase of leaf area.

Table.1 Vegetative parameters

Treatments	P_1	P_2	P_3	P_4	P_5
T_1	8.17	8.63	2.48	1.90	17.07
T_2	6.60	9.13	2.74	2.03	16.30
T_3	9.40	8.97	3.02	1.87	19.23
T_4	9.20	10.07	2.75	1.80	18.53
T_5	8.00	8.33	3.12	1.67	22.13
T_6	8.43	9.50	3.16	1.93	24.90
T_7	7.33	9.80	2.85	2.03	21.03
T_8	7.37	8.20	3.30	1.73	20.13
T_9	8.17	8.60	2.39	2.17	22.80
SEm (+)	0.38	0.37	0.19	0.16	1.69
CD(0.05)	1.13	1.12	0.56	NS	5.0372

Table.2 Flowering parameters

Treatments	P_6	P_7	P_8	P_9
T_1	6.43	9.17	7.87	4.54
T_2	6.63	8.27	7.00	4.86
T_3	6.93	9.03	8.30	4.96
T_4	6.80	9.17	8.50	5.00
T_5	6.93	7.77	7.77	4.80
T_6	6.87	8.60	8.53	4.91
T_7	6.80	9.87	8.63	5.21
T_8	6.57	9.10	8.77	4.90
T_9	6.93	9.00	8.10	5.07
SEm (+)	0.21	0.60	0.19	0.18
CD(0.05)	NS	NS	0.56	NS

Flowering attributes

Days to full bloom from visible bud emergence (P_6)

Spraying of plant growth regulating chemicals on pansy failed to show significant variation among all the treatments. However, the highest value was recorded (Table 2) with control treatment T_9 (6.93) and lowest value recorded with T_1 (6.43). Therefore, application of plant growth regulators have no significant effect on days taken to full bloom from bud which was in same line with findings by Lu and Chen (1996) on *Petunia hybrid* where spraying with plant growth chemical had no impact on early flowering.

Number of flowers per plant (P_7)

Spraying of plant growth regulating chemicals on pansy failed show significant effect in controlling the number of flower per plant. The highest value (Table 2) recorded with T_7 (9.87) and lowest value recorded with T_5 (7.77). With the advancement of growth flower number increased gradually.

It may be due to weather condition or may be varietal character.

Flower diameter in cm (P_8)

Spraying of plant growth regulating chemicals on pansy had shown the significant effect in controlling flower diameter. Table 2 showed that maximum flower diameter obtained from T_8 (8.77) which is statistically at par with T_7 (8.63), T_6 (8.53), T_4 (8.50) and T_3 (8.30) and minimum value obtained from T_2 (7.00). Here, GA_3 is most effective to give significant variation on flower diameter of pansy. The dose used here helped to increase flower size as studied by Kamuro *et al.,* (2001).

Days to flower senescence from full bloom (P_9)

From Table 2, it is evident that spraying of plant growth regulating chemicals on pansy failed show significant effect in controlling the days taken to senescence from full bloom. However, highest value recorded with T_7 (5.21) and lowest value recorded with T_1 (4.54). Therefore, none of these chemicals have role on promote or regulate senescence on pansy.

The result reflected the efficacy of cycocel to the highest degree on plant height might be due to their mode of action. Paclobutrazol

reduced the height by blocking multiple steps in biosynthesis of gibberellins and steroids. There was no significant variation in number of tertiary branches per plant due to application of growth regulating chemicals. Among the plant growth regulators GA_3 was most effective to give significant variation on flower diameter of pansy. Therefore, individual growth regulator showed partial beneficial effect on all the plant character studied in plains of West Bengal. However, from the whole course study it can be concluded that under the West Bengal agroclimate, GA_3 and paclobutrazol cited best in regulating plant phenotypic expression, as paclobutrazol kept plant height short and GA_3 increased flower diameter per plant maintaining higher bloom quality.

Acknowledgement

The paper is based on the findings of an experiment sincerely carried out at Horticultural Research Station, Mandouri, Bidhan Chandra Krishi Viswavidyalaya under the department of Floriculture and Landscape Architechture. All authors are thankful to the department for careful guidance and encouragement.

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How to cite this article:

Ayandip Biswas, Tapas Mandal, Srabani Das and Bipra Thakur. 2018. Effect of Plant Growth Regulators on Growth and Flowering of Pansy (*Viola x wittrockiana* Gams.) under West Bengal Condition. *Int.J.Curr.Microbiol.App.Sci.* 7(01): 2125-2130.
doi: https://doi.org/10.20546/ijcmas.2018.701.256