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Effect of Organic Nutrients and Growth Regulators on Yield and Quality of Goldenrod (*Solidago canadensis* L)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

An Investigation was conducted to study the effect of organic inputs and growth regulators on yield and quality of goldenrod (*Solidago canadensis*) was conducted at the floricultural unit, Department of Horticulture, Faculty of Agriculture, Annamalai University during 2018. The experiment was laid out in randomized block design with twelve treatments, various organic inputs and growth regulators including panchagavya @ 3%, vermiwash 1:5 dilutions, humic acid @ 0.2%, GA_3 @ 250 ppm, NAA @ 250 ppm were applied. The yield and quality characters were studied at different stages. The observations recorded viz., yield of flower stalks/ha, days to first flowering, length of flower stalks and weight of individual flower stalks. The results revealed that plants treated with NAA @ 250 ppm + panchagavya @ 3% (T_9) was observed highest flower stalk yield (1140.02 flower stalks/ha), No. of flower stalks/plant (24.48), weight of individual flower stalks, days to first flowering. Considering the overall performance, it was found that the plants treated with NAA @ 250ppm + Panchagavya @ 3% recorded better performance with regard to growth, yield and quality characters.

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Keywords: Goldenrod; organic inputs; growth regulators.

1. INTRODUCTION

Goldenrod (*Solidago canadensis* L.) belongs to the family Asteraceae. It is native to North America. Goldenrods have small yellow clustered flowers, often seen in panicles, along a thin stick like stem. The genus *solidago* comprises of about 60 to 130 species. Some species yielded a dye and the leaves of many species of goldenrod used for medicinal preparations and tea making. Goldenrod is generally used as cut flower for indoor decoration in vases and used either singly (or) with other flowers in flower bouquets. Goldenrod plants have multiple uses, from providing shelter to larvae of beneficial insects to attracting butterflies. Goldenrod plants provide nectar for migrating butterflies and bees, encouraging them to remain in the area and pollinate your crops. It is an inevitable cut flower used in indoor decorations and filler flower crop in flower arrangements. Achieving lengthy spikes with compact clusters of flowers is the vital thing in production of goldenrod.

The current research work on this crop is to improve growth and yield of flowers and enhance the flower quality using growth regulators and organic inputs. The present investigation entitled "Studies on Effect of organic nutrients and growth regulators on growth, yield and quality of goldenrod (*Solidago canadensis* L.) Was taken up with the following objectives.

1. To study the effect of foliar application of growth regulators *viz.,* gibberellic acid, NAA and humic acid on growth, yield of goldenrod.
2. To study the influence of organic inputs *viz.,* panchagavya and vermiwash on growth, yield of goldenrod.
3. To fix optimum combination of organic inputs and growth regulators for maximum growth, yield of goldenrod.

2. MATERIALS AND METHODS

The studies on " Effect of organic nutrients and growth regulators on yield and quality of goldenrod (*Solidago canadensis* L.)'' was carried out in the floriculture unit, Department of Horticulture, Annamalai University, Annamalainagar, Tamil Nadu during 2018.The goldenrod suckers were procured from southern flora flower farm in Hosur. The goldenrod plants are raised through suckers and each suckers are 15-20g weight with 45×45 cm spacing. Using randomized block design with twelve treatments and three replication. Observations were recorded at the yield parameters viz., yield of flower stalks, length of flower stalks, weight of individual flower stalks, days to first flowering. There are twelve treatment solution which are used for increase growth and yield and the treatment details are given below,

2.1 Treatment Details

T_1	Gibberellic acid @ 250ppm
T_2	Panchagavaya @ 3%
T_3	Vermiwash 1:5
T_4	NAA @ 250ppm
T_5	Humic acid @ 0.2 %
T_6	Gibberellic acid @ 250ppm+ Panchagavaya @ 3%
T_7	Gibberellic acid @ 250ppm+ Vermiwash 1:5
T_8	Gibberellic acid @ 250ppm+ Humic acid @ 0.2 %
T_9	NAA @ 250ppm+ Panchagavaya @ 3%
T_{10}	NAA @ 250ppm + Vermiwash 1:5
T_{11}	NAA @ 250ppm+ Humic acid @ 0.2 %
T_{12}	Control

3. RESULTS AND DISCUSSION

3.1 Number of Days taken for First Flowering

Among the treatments in T_9 (NAA@ 250ppm + panchagavya @ 3%) recorded earlier flowering (60.45 days). In T_{10} (NAA@ 250ppm + vermiwash 1:5) and also the flowering was very early (61.33) when compared with control (T_{12}) which took 70.13 days. The first flowering occurred very early within 60.54 days in plants treated with NAA @ 250 ppm and Panchagavya @ 3%. It might be due to the fact that the presence of growth promoting substances such as GA_3 and Panchagavya making nutrients readily available along with presence of many PGPR's might have lead to early flowering [1].

3.2 Number of Flower Stalks per Plant

The treatment with application of T_9 (NAA@ 250ppm + panchagavya @ 3%) recorded the highest number of flower stalks per plant (24.48) which was on par with treatment T_{10} (NAA@ 250ppm + Vermiwash1:5) that recorded 23.71

Table 1. Effect of organic nutrients and growth regulators on yield and quality of goldenrod

Treatment Details	Days to first flowering	Number of flower stalks/plant	Length of flower stalk(cm)	Weight of individual flower stalk(g)	Yield of flower stalks/ha ('000nos)
T_1-Gibberellic acid @ 300ppm	66.61	19.09	39.09	9.37	930.09
T_2-Panchagavaya 3 %	69.25	16.78	33.87	8.35	840.12
T_3-Vermiwash 1:5	68.37	17.55	35.61	8.69	870.11
T_4-NAA @250ppm	63.97	21.40	44.31	10.39	1020.06
T_5-Humic acid @ 0.2 %	67.49	18.32	37.35	9.03	900.10
T_6-Gibberellic acid @ 250ppm + Panchagavaya @ 3 %	62.21	22.94	47.79	11.07	1080.04
T_7-Gibberellic acid @ 250ppm + Vermiwash 1:5	64.85	20.63	42.57	10.05	990.07
T_8-Gibberellic acid @ 250ppm+ Humic acid @ 0.2 %	65.73	19.86	40.83	9.71	960.08
T_9-NAA @ 250ppm+ Panchagavaya @ 3 %	60.45	24.48	51.27	11.75	1140.02
T_{10}-NAA @ 250ppm + Vermiwash 1:5	61.33	23.71	49.53	11.41	1110.03
T_{11}-NAA @ 250ppm+ Humic acid @ 0.2 %	63.09	22.17	46.05	10.73	1050.05
T_{12}-Control	70.13	16.01	32.13	8.01	810.13
SE(d)	0.34	0.28	0.77	0.07	14.89
CD(0.05)	0.68	0.57	1.54	0.14	29.79

stalks per plant. This was followed by the treatment T_{11} (NAA @ 250ppm + humic acid @ 0.2%) which recorded 22.17 number of flower stalks per plant. The control recorded the least number of (16.01) flower stalks per plant which was on par with T_2 (panchagavya @ 3%) with 16.78 flower stalks/plant. This increase might be due to increase photosynthesis efficiency with enhancing carbohydrate fixation in NAA treated plants. These results were in accordance with findings of Ravidas et al. [2] and Maurya and Nagda [3] in gladiolus.

3.3 Flower Stalk Length

The plants that received the application of T_9 (NAA @ 250ppm + panchagavya @ 3%) recorded the highest stalk length of 51.27 cm at the time of harvest and this was followed by the treatment T_{10} (NAA@ 250ppm + Vermiwash1:5) recorded the stalk length of 49.53 cm. The control (T_{12}) recorded a stalk length of 32.13 cm at the time of harvest. The least stalk length of 33.87 cm was recorded in T_2 (Panchagavya @ 3%) was on par with T_3 (Vermiwash 1:5) which recorded 35.61 cm. Sharma et al. [4] revealed that application of NAA @100ppm recorded maximum number of cormels / plant (39.4), maximum weight (33.6g) and size (4.78 cm) in gladiolus.

3.4 Weight of Individual Flower Stalk

The plants treated with T_9 (NAA @ 250ppm + Panchagavya @ 3%) recorded the highest individual flower stalk weight (11.75 g). This was on par with T_{10} (NAA @ 250ppm + Vermiwash 1:5) which recorded 11.41 g. The next best treatment was T_6 (NAA @ 250ppm +humic acid @ 0.2%) with 10.73 g, which was on par with T_4 (NAA @ 250ppm) which recorded 10.39 g. The treatment T12 (control) recorded the lowest individual flower stalk weight (8.01 g). The results were in agreement with findings of Thamaraiselvi et al. [5] who found increased flower weight in treatment containing combination of panchagavya in rose, Somasundaram et al. [1], Lourduraj et al. [6] in rice, Djanaguiraman *et al.* (2005) in tomato.

3.5 Yield of Flower Stalks per Hectare

The treatments T_9 (NAA @ 250ppm + Panchagavya @ 3%) produced the highest yield of flower stalks per hectare (108004 flower stalks ha^{-1}) which was followed by T_{10} (NAA @ 250ppm + Vermiwash 1:5) registered (111003 flower stalks ha^{-1}) and it was on par with T_{11} (NAA @ 250ppm + Humic acid @ 0.2%) and T_4 (NAA @ 250ppm) which recorded (105005 and 102006 flower stalks ha^{-1}) The lowest yield of flower stalks per hectare (81013 flower stalks ha^{-1}) was recorded in T_{12} (control). This increase is due to the auxin which stimulated availability of food materials and carbohydrate supply which ultimately effects the flower production. Such response due to NAA application was reported previously by Dutta et al. [7,8], Kumar and Ugherja [9] in chrysanthemum. Pandya [10] in marigold; Maurya and Nagda [3] in gladiolus.

4. CONCLUSION

In this study treatment combination T_9 (NAA @ 250 ppm + Panchagavya @ 3 %) recorded the highest flower stalks yield, No. of flower stalks/plant, flower stalk length, weight of individual flower stalk, yield of flower stalks/ha, No.of days taken for first flowering.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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