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EXAMINE THE IMPACT OF MULCHES AND PLANT GROWTH REGULATORS ON STRAWBERRY'S YIELD AND GROWTH

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Abstract

In the years 2021–22 and 2022–23, a field experiment was conducted at Glocal University to investigate the impact of mulches and plant growth regulators on the development and yield of strawberries. There were three replications and seventeen treatments in the randomized block design experiment. The findings showed that the development and yield of strawberries are impacted by various mulches and plant growth regulators. Plant height (24.4 cm), number of leaves per plant (28.5), leaf length (9.4 cm), and petiole length (12.4 cm) are the maximum values. Using GA3 75ppm + black polyethylene, the number of flowers (30.1), fruits (24.1) and fruit weight (13.6g) per berry were observed. However, in treatment Control, the minimum values of these parameters were noted.

Keywords: strawberry, PGRs, mulching, growth, yield characters

Introduction

Strawberry (*Fragaria* × *ananassa* Duch.) is an important fruit crop of the family Rosaceae. The attractive red colour, pleasant aroma, and high nutritional value in terms of vitamins (A and C) and minerals (Fe and K) make this fruit highly prized in global markets. Besides the fresh consumption, strawberry fruits are also being used to prepare jam and jellies due to the presence of a high amount of pectin. Strawberry fruits have a fair amount of natural antioxidants that are useful for relieving oxidative stresses (Sharma and Thakur, 2008). Consumption strawberry berry helps in the prevention of various types of cancers and heart-related diseases. This fruit is also reported to be beneficial in the reduction of inflammation and obesity-related disorders (Arfin *et al*., 2016) [1]. For these reasons the demand for strawberries in the markets is increasing gradually and the growers are also encouraged to cultivate this crop to gain higher income. Scientific evidence has also suggested that the strawberry plant responded well to growth regulator application (Jain and Dashora, 2011). Among the plant growth regulators, naphthalene acetic acid (NAA) and gibberellins (GA3) have been widely tested in the modern agricultural system due to their suitability of application at a cheaper rate. The role of these plant growth regulators has been investigated in several fruits by (Bist *et al.*, 2018) [2].

Strawberry is a low surface creeping herb and, hence, mulching plays a very important role in soil moisture conservation, weed control, and regulation of soil hydrothermal regimes. In addition, mulching also improves the vegetative growth of the plant and the quality of strawberry. Better vegetative growth is important for healthy and vigorous runner production in strawberry where the production of quality planting material is a great concern. However, there are very few reports on the effect of mulches on vegetative growth and runner production of strawberries. Therefore, an investigation was conducted to study the effect of various growth regulators and mulches on the vegetative growth of strawberry.

Materials and Methods

The experiment was carried out at the Horticulture Research Farm Glocal University, Saharanpur (U.P.) during the year 2021-22 and 2022-23. The experiment was laid out in a randomized block design with seventeen treatment combinations i.e., T1 Control, T2GA3 50ppm + black polyethylene, T3GA3 75ppm + black polyethylene, T4GA3 50ppm + transparent polyethylene, T5GA3 75ppm + transparent polyethylene, T6GA3 50ppm + paddy straw, T7GA3 75ppm + paddy straw, T8GA3 50ppm + rice husk, T9GA3 75ppm + rice husk, T10NAA 20ppm +black polyethylene, T11NAA 40ppm +black polyethylene, T12NAA 20ppm + transparent polyethylene, T13 NAA 40ppm + transparent polyethylene, T14NAA 20ppm + paddy straw, T15NAA 40ppm + paddy straw, T16NAA 20ppm + rice husk and T17NAA 40ppm + rice husk. Each replicated three times sixteen plants per plot. The runners of strawberry were planted at a spacing of 30 x 30 cm. The uniform dose of FYM 20 t/ha and N (80 kg/ha) as Urea, P2O5 (40 kg/ha) as SSP, and K2O (50 kg/ha) as M.O.P. were applied at the time of field preparation. Black and transparent polyethylene of 200 gauge paddy straw and sawdust were spread in plots. The plant growth regulators were applied on the 30th and 45th days after planting on strawberry. The required quantity of gibberellic acid and naphthalene acetic acid was measured by measuring cylinder and dissolved in a small quantity of absolute ethyl alcohol and NH4OH, respectively and then the final volume was made up to one liter with distilled water. The stock solution of the chemicals was diluted with tap water for preparing the prepared foliar spray required to strengthen sprayed on the upper surface of the plant thoroughly with the help of a hand sprayer. The observations were recorded on various parameters like plant height, number of leaves/plant, length of leaf, length of petiole, days taken to first flower, days took to 50% flower, number of flowers/plant, number of fruits per plant, and fruit weight per berry.

Result and Discussion

During the course of the investigation, it has been observed was a significant increase in plant height with the application of different types of mulching and plant growth regulators in combination, GA3 75ppm + black polythene was the most effective combination in retaining maximum (24.4 cm) plant height followed by (24.3 cm), with GA3 50ppm + black polyethylene while the minimum plant height (14.8 cm) was recorded with treatment control during two years. The possible reason for increased plant height might be due to the application of mulching and plant growth regulators treatments which led to a congenial environment in the root zone due to lower weed population, optimum soil moisture level, increased availability of nutrients, and favorable soil temperature, and regulated growth of strawberry plant by causing cell elongation and a corresponding increase in length of petiole by application of GA3. These results are in consonance with that Tiwari *et al*. (2017) [12]

A maximum number of leaves per plant (28.0), length of leaves (9.4 cm), and length of the petiole (12.4 cm) were observed in (GA3 75ppm + black polyethylene) followed by (26.4, 9.2, and 12.1 cm) with GA3 50ppm + black polyethylene. The possible reason maximum number of leaves the ability of gibberellins to stimulate the process of cell division and expansion in epidermal and parenchyma cells has been well documented (*Bist et al.*, 2018) [2]. Such activities in the meristematic tissue of leaf primordial in GA3 treated plants might be higher and perhaps a greater number of leaves with broader leaf lamina and petiole of longer length. A higher concentration of GA3 increases the above mechanisms many folds. Earlier findings also suggested that exogenous application of GA3 induced a higher number of leaves (Kaur *et al.*,2017) [7] However, a very high concentration of GA3 (125 mg|-1) resulted in slightly stunted growth in strawberry plants. Since, application of GA3 at high concentration is reported to have an inhibitory action in plants (Hedden and Sponsel, 2015) [4].

The minimum days taken to first flower (31.3 days) and (43.0 days) in 50% flowering the present investigation were recorded with the application of NAA 20ppm +black polyethylene possible reasons for minimum days taken to first flowering and 50% flowering because of generally auxin and particularly NAA induces flowering by stimulating florigen which moved from petiole to growing tip and converts vegetative bud to flowering bud and fruit set refers to the change in the ovary leading to the development of the fruit. These changes are usually induced after pollination and fertilization which is triggered by NAA. The results are congruent with Kumar *et al.*, 2011 [5].

The maximum number of flowers (30.1) and a number of fruits per plant (24.1) were found with the application ofGA3 75ppm + Black polyethylene. The number of flowers and fruits per plant because of hormone application accelerated the development of differentiated inflorescence and stimulated flowering. Mulching provided optimum soil moisture and temperature due to the application of GA3 and black polyethylene mulch as reported by Kumar *et al.*, (2012) [6] in strawberry. Application of GA3 75ppm + Black polyethylene recorded maximum fruit weight par berry (13.6 g) with respect to other treatments. This might be due to fact that such treatment-induced good vegetative growth and flower bunch hence initiated a higher number of flowers and percent berry set. This could also be attributed to the improvement in the water, which might increase the photosynthetic rate causing maximum fruit weight. These observations are supported by the findings of Nor *et al*. (2014) [9].

Table 1: Effect of plant growth regulators and mulches on growth and yield of strawberry cv. Chandler (mean of 2 years)

Treatment Combinations	**Plant height (cm)**	**Number of leaves per plant**	**Length of the leaf (cm)**	**Length of the petiole (cm)**	**Days took to first flower**	**Days took to50% flowering**	**Number of flowers perplant**	**Number of fruits per plant**	**Fruit weight par berry (g)**
T1 Control	18.8	20.5	7.1	9.4	38.3	49.0	12.1	8.4	10.0
T2GA3 50ppm + Black polyethylene	24.3	26.4	9.2	12.1	34.8	45.1	28.5	22.9	13.4
T3GA3 75ppm + Black polyethylene	24.4	28.0	9.4	12.4	35.1	45.4	30.1	24.1	13.6
T4GA3 50ppm + Transparent polyethylene	24.1	25.5	9.0	11.5	35.4	45.9	26.5	22.3	12.6
T5GA3 75ppm + Transparent	24.2	25.8	9.2	11.7	35.8	45.9	28.0	22.6	13.0
polyethylene									
T6GA3 50ppm + Paddy straw	23.4	25.2	8.5	10.9	36.1	46.6	25.3	18.5	12.1
T7GA3 75ppm + Paddy straw	23.9	25.2	8.8	11.1	36.4	46.9	25.0	19.3	12.3
T8GA3 50ppm + Rice husk	22.4	24.5	8.3	10.6	36.8	46.9	23.	17.8	11.

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T9GA3 75ppm + Rice husk	23.1	25.0	8.5	10.7	37.3	47.2	24.0	18.4	11.8
T10NAA 20ppm +Black polyethylene	21.7	24.3	8.3	10.5	31.3	43.0	22.6	17.3	11.6
T11NAA 40ppm +Black polyethylene	21.6	24.1	8.1	10.5	31.8	43.3	22.3	16.9	11.4
T12 NAA 20ppm + Transparent polyethylene	21.6	23.7	7.7	10.3	32.5	43.5	21.8	15.6	11.2
T13 NAA 40ppm + Transparent polyethylene	21.1	22.6	7.6	10.2	32.8	43.8	21.1	14.9	10.9
T14NAA 20ppm + Paddy straw	20.9	22.4	7.5	10.1	33.3	44.0	19.1	12.1	10.9
T15NAA 40ppm + Paddy straw	20.3	22.1	7.4	9.9	33.8	44.2	18.5	11.8	10.7
T16NAA 20ppm + Rice husk	19.8	21.9	7.3	9.7	34.1	44.7	16.6	11.4	10.4
T17NAA 40ppm + Rice husk	19.1	20.9	7.3	9.6	34.6	45.0	15.8	10.4	10.2
CD (P=0.05)	1.30	1.72	0.64	1.02	1.43	1.59	1.59	1.45	1.26

Conclusion

There were three replications and seventeen treatments in the randomized block design experiment. The findings showed that the development and yield of strawberries are impacted by various mulches and plant growth regulators. Plant height (24.4 cm), number of leaves per plant (28.5), leaf length (9.4 cm), and petiole length (12.4 cm) are the maximum values. Using GA3 75ppm + black polyethylene, the number of flowers (30.1), fruits (24.1) and fruit weight (13.6g) per berry were observed. However, in treatment Control, the minimum values of these parameters were noted.

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