The Pharma Innovation Journal 2021; 10(12): 987-990

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 987-990

www.thepharmajournal.com
Received: 02-09-2021
Accepted: 09-11-2021

M Mathivanan
M.Sc. Department of Forest Biology and Tree Improvement, Forest College and Research institute, (TNAU), Coimbatore, Tamil Nadu, India

K Kumaran
Professor and Head, Department of Forest Biology and Tree Improvement, Forest College and Research Institute, (TNAU), Coimbatore, Tamil Nadu, India

P Boominathan
Associate Professor, Plant Physiology, Department of Agroforestry, Forest College and Research Institute, (TNAU), Coimbatore, Tamil Nadu, India

V Priyanka
Teaching Assistant, Department of Forest Biology and Tree Improvement, Forest College and Research Institute, (TNAU), Coimbatore, Tamil Nadu, India

Corresponding Author:
M Mathivanan
M.Sc. (Forestry) Forest Biology and Tree Improvement Forest College and Research institute, (TNAU), Coimbatore, Tamil Nadu, India

Effect of foliar application of plant growth regulators on morphological and yield traits in Neem (*Azadirachta indica* A. Juss)

M Mathivanan, K Kumaran, P Boominathan and V Priyanka

Abstract
This experiment was conducted with the aim to estimate the effect of plant growth regulators on fruit, seed morphology and yield in Neem. In this study we gave used five growth regulators with two different concentrations such as Naphthalene acetic acid, ethylene, mepiquat chloride, cycocel, and triacontanol. Plant growth hormones are organic compounds that influence the various physiological processes in trees when applied in minimum concentrations. On its exogenous application, it will quickly penetrate and will be easily absorbed by the plant tissues. The maximum values of fruit and seed morphological traits were recorded in the triacontanol at 1000ppm followed by ethylene at 1000ppm *viz.*, Fruit length (20.87 mm), fruit width (13.89 mm), 100 fruit weight (134.19g), seed length (24.17 mm), seed width (7.27 mm), 100 seed weight (24.17 g). The tree treated with triacontanol at 1000ppm was maximum fruit yield (12.33 Kg) and seed yield (3.78 Kg).

Keywords: Neem, foliar – spray, triacontanol, seed, fruit morphology, yield

Introduction
Neem (*Azadirachta indica* A. Juss) is a multipurpose tree found in the Indian subcontinent. It's a large evergreen tree that can grow up to 20 meters height and has a diameter of 2.5 meters. Neem trees are distributed in 80 countries globally, with an approximate world's population of 120 million trees (Dhillion *et al.*, 2008) [10].

The tree is valuable and remarkable in our country because of its vital role in the Indian ecosystem. Since the Vedic period, multidirectional neem based medicinal applications followed in India (Narong *et al.*, 2014) [11]. Over 700 herbal products are based on neem, including ayurveda, siddha, unani, and amchi in various sections of the nation (Viradia and Singh, 2004) [19]. Neem tree is named by the source of allelochemicals, especially for the insecticidal, insect repellant, and growth regulation activities of neem kernel extract. The main active component is azadirachtin, a tetranortriterpenoid with traditional insect growth regulatory (IGR) actions on juvenile stages of insects (Tandom *et al.*, 2011) [17].

Plant growth regulators play a vital role in neem to increase the yield of high-quality fruits and enhance the morphological characters (Yadav *et al.*, 2004) [21]. Because fruits are high-value commodities in neem, it is beneficial to fruit yield and quality by foliar application of plant growth regulators (Suman *et al.*, 2017) [16]. Exogenous use of plant growth regulators helps sustain optimal fruit setting (Aliyu *et al.*, 2014). Plant growth regulators sprays are used to either enhance fruit size directly by encouraging cell division or indirectly by lowering fruit quantity that limit the number of flowers generated or induce flower or fruit abscission (Sajjad *et al.*, 2014) [13].

Hence, an effort was made to improve the fruit and seed morphological characters through the application of plant growth regulators at different concentrations.

Material and Methods
This study was carried out in fourteen years old neem plantations at Pathamadai, Tirunelveli (8º38'N, 77º35'E, 47 meters MSL, Rainfall 680 mm) during the year 2021. This experiment has eleven treatments with three replications and each replication contained 5 trees. Application of the plant growth regulators was done between 6.00 AM to 9.00 AM through foliar spray. The trees were fully wetted with plant growth regulators with the help of a rocker sprayer, after the application of chemicals, the field was irrigated properly.

Treatment details

Treatments	Plant growth regulators	Concentration
T_1	Naphthalene acetic acid	100ppm
T_2	Naphthalene acetic acid	200ppm
T_3	Ethylene	500ppm
T_4	Ethylene	1000ppm
T_5	Mepiquat chloride	500ppm
T_6	Mepiquat chloride	1000ppm
T_7	Cycocel	500ppm
T_8	Cycocel	1000ppm
T_9	Triacontanol	500ppm
T_{10}	Triacontanol	1000ppm
T_{11}	Control	

Observation records

Variation in fruit and seed attributes

Fruit length (mm), fruit width (mm), 100 fruit weight (g), seed length (mm), seed width (mm), 100 seed weight (g), fruit to seed ratio, seed to kernel ratio (Prabakaran, 2020) [12] and yield (Sudha *et al.*,2012) [15] were measured the seeds from the treated trees

Statistical analysis

The final data were statistically analyzed by ANOVA using of Randomized block design through Aggress software

Results

Effect of Plant growth hormones on fruit and seed morphology

a. 100 fruit weight (g)

The maximum weight, 134.19 g was recorded in T_{10} (Triacontanol at1000ppm) and the minimum was in control 93.58 g.

b. Fruit length (mm)

T_{10} (Triacontanol at 1000ppm) expressed the maximum fruit length with the value of 20.87 mm followed by T_4 (Ethylene at 100ppm) 18.77 mm. The minimum value was in T_2 (Naphthalene acetic acid at 200ppm) the value is 13.87.

c. Fruit width (mm)

In case of fruit width, two treatments *viz.*, Triacontanol at1000ppm and ethylene at 1000ppm showed maximum values 13.89 mm and 12.86 mm respectively and control with minimum value (7.54 mm).

d. 100 seed weight (g)

The maximum 100 seed weight (24.17 g) was recorded in T_{10} (Triacontanol at1000ppm) and the minimum was measured in T_1 (Naphthalene acetic acid at 100ppm) 15.01 g.

e. Seed length (mm)

T_{10} (Triacontanol at1000ppm) expressed maximum fruit length with the value of 15.68mm followed by T_4 (Ethylene at 1000ppm) 15.35 mm. The lower value was recorded in T_2 (Naphthalene acetic acid at 200ppm) the value is 9.40 mm.

f. Seed width (mm)

In case of seed width two treatments *viz.* Triacontanol at1000ppm and Ethylene at 1000ppm showed maximum values (7.27 mm and 7.15 mm) and T_2 (Naphthalene acetic acid at 200ppm) with a minimum value of 5.99 mm.

Effect of plant growth regulators on fruit and seed yield

a. Fruit yield (Kg)

The neem fruit yield was registered maximum in T_{10} (Triacontanol at1000ppm) with the value of 12.33 kg followed by T_4 (Ethylene at 1000ppm) (7.99 kg.) and the minimum fruit yield of 2.46 kg was documented in control.

b. Seed yield (Kg)

T_{10} (triacontanol at1000ppm) treatment was registered significantly higher seed yield (3.78 kg) followed by T_4 (Ethylene at 1000ppm) (1.78 kg) and control (0.66 kg) was the least performing treatment, compared to a grand mean (1.33 kg)

Discussion

Effect of growth regulators on fruit and seed morphology of neem trees

In this experiment, triacontanol and ethylene treatments improved the morphological characteristics of the fruit and seeds, such as fruit length, fruit width, 100 fruit weight, fruit length, 100 seed weight, seed length, and seed width. Anusuya *et al.* (2018) [5] observed the similar results in mango tree treated with triacontanol at 500ppm, which enhanced morphological characteristics of the fruit, seed and fruit yield (35kg/ tree) and also this results was supported by Anees *et at.* (2011) [4] studies on mango fruit. Triacontanol proved vital in cell division and elongation, which led to early maturation (Wang *et al.*, 2005) [20].

Fruit yield was directly associated with time and flowering intensity. Plant growth regulators were the only substance that might improve hermaphrodite flowers, shoot growth, and photosynthetic rate (Amasino *et al.*, 2020). Triacontanol foliar spray increased the glucose stored in shoots via anti-gibberellin action in nature, which resulted in cell division (Subbaiah *et al.*, 2018 and Teto *et al.*, 2016) [14, 18].

Effect of plant growth regulators on fruit and seed yield

Triacontanol at 1000ppm produced the higher seed yield, followed by ethylene at 1000ppm. Among all treatments, control registered the least fruits (Kg) per tree. Ahmed *et al.* (2019) [1] in olive, Bhagwan *et al.* (2014) [8] in almond and Bhowmick *et al.* (2014) [9] in mango demonstrated similar increase in fruit yield which prove that the triacontanol play a major role in increasing the fruit yield (Kg). Similar findings documented in mango, the use of triacontanol has dramatically enhanced fruit yield (Bhagwan *et al.*, 2010) [7] and (Bhagwan *et al.*, 2009) [6]

Table 1: Effect of plant growth regulators on fruit morphology

Treatment	Plant growth regulators	100 fruit weight (g)	Fruit length (mm)	Fruit width (mm)
T_1	NAA@100ppm	94.23	12.32	7.91
T_2	NAA@200ppm	95.63	13.87	9.86
T_3	Ethylene@500ppm	120.53**	15.38	11.18**
T_4	Ethylene@1000ppm	131.16**	18.77**	13.30**
T_5	Mepiquat chloride@500ppm	104.63	18.10**	12.86**
T_6	Mepiquat chloride@1000ppm	105.53	17.47	11.56**

T_7	Cycocel@500ppm	99.70	14.78	11.21**
T_8	Cycocel@1000ppm	109.60	15.78	8.24
T_9	Triacontanol@500ppm	122.56**	16.48	12.28**
T_{10}	Triacontanol@1000ppm	134.19**	20.87**	13.89**
T_{11}	Control	93.58	17.83	7.54
Mean		115.95	17.76	10.52
SEd		1.04	0.11	0.14
CD (=0.05)		2.32	0.23	0.31
CD (=0.01)		3.09	0.67	0.97

***** Significantly different at (0.05)
****** Significantly different at (0.01)

Table 2: Effect of plant growth regulators on seed morphology

Treatment	Plant growth regulators	100 seed weight (g)	Seed length (mm)	Seed width (mm)
T_1	NAA@100ppm	15.01	9.42	6.06
T_2	NAA@200ppm	15.80	9.40	5.99
T_3	Ethylene@500ppm	17.76	10.978	6.51
T_4	Ethylene@1000ppm	22.34*	15.35**	7.15**
T_5	Mepiquat chloride@500ppm	16.80	12.40	6.99**
T_6	Mepiquat chloride@1000ppm	15.81	11.32	6.05
T_7	Cycocel@500ppm	16.11	12.11	6.95*
T_8	Cycocel@1000ppm	17.20	13.28	7.01**
T_9	Triacontanol@500ppm	18.74	12.99	6.63
T_{10}	Triacontanol@1000ppm	24.17*	15.68**	7.27**
T_{11}	Control	16.06	14.11	6.55
Mean		19.22	13.97	6.93
SEd		0.44	0.08	0.01
CD (=0.05)		0.98	0.18	0.02
CD (=0.01)		1.78	0.31	0.04

***** Significantly different at (0.05)
****** Significantly different at (0.01)

Table 3: Effect of plant growth regulators on neem fruit and seed yield

Treatment	Plant growth regulators	Fruit yield (kg)	Seed yield (kg)
T_1	NAA@100ppm	2.54	0.54
T_2	NAA@200ppm	3.75	0.75
T_3	Ethylene@500ppm	6.76**	1.64
T_4	Ethylene@1000ppm	7.96**	1.78
T_5	Mepiquat chloride@500ppm	2.56	0.85
T_6	Mepiquat chloride@1000ppm	3.34	0.50
T_7	Cycocel@500ppm	4.98	1.00
T_8	Cycocel@1000ppm	5.92	1.50
T_9	Triacontanol@500ppm	6.50*	1.64
T_{10}	Triacontanol@1000ppm	12.33**	3.78**
T_{11}	Control	2.46	0.66
Mean		5.37	1.33
SEd		0.49	0.23
CD (=0.05)		1.03	0.48
CD (=0.01)		1.40	0.66

***** Significantly different at (0.05)
****** Significantly different at (0.01)

Conclusion
The study concluded that fruit and fruit morphological traits *viz.*, fruit length (mm), fruit width (mm), 100 fruit weight (g), seed length (mm), seed width (mm), 100 seed weight (g) has recorded maximum in triacontanol at 1000ppm followed by ethylene at 1000ppm. The tree treated with triacontanol at 1000ppm produced maximum fruit yield (Kg) and seed yield (Kg). Triacontanol at 100ppm was increased the fruiting percentage to 85% than control. Finally we conclude triacontanol at 1000ppm was improved the quantity of quality fruits in neem.

Reference

1. Ahmed, Zienab FR, Eman MA Taha, Naglaa AA. Floral Behavior, Fruit Characteristics and Oil Quality of Some Olive Cultivars *Oleaeuropaea* L 2019.
2. Aliyu, Olawale Mashood, Oluwayemisi Oluwatosin Adeigbe, Joshua Adedokun Awopetu. Foliar application of the exogenous plant hormones at pre-blooming stage improves flowering and fruiting in cashew (*Anacardium occidentale* L.). Journal of Crop Science and Biotechnology 2011;14(2):143-150.
3. Amasino RM, Michaels SD. The timing of flowering. Plant Physiology 2010;154(2):516-520.
4. Anees M, Tahir FM, Shahzad J, Mahmood N. Effect of foliar application of micronutrients on the quality of mango (*Mangifera indica* L.) cv. Dusehri fruit. Mycopathologia 2011;9(1):25-28.
5. Anusuya R, Vijayakumar RM, Srividhya S, Sivakumar R. Comparison of physiological and flowering parameters of

main and off season by using different plant nutrients and growth hormone in mango (*Mangifera indica* L.) cv. Bangalora. Journal of Agriculture and Ecology 2018;5:76-82.
6. Bhagwan AGS Reddy, Reddy ML. Effect of different forms of potassium based foliar spray on flowering and fruiting in mango cv. Banganapalli. National seminar on production, post-harvest technology and marketing of mango, held at HC & RI, TNAU, Periyakulam, from 23 - 25 September 2009, 129-131.
7. Bhagwan A, Vijaya Krishna, Rajkumar M. Synergestic effects of plant growth regulators and fruit set improving chemicals on flowering, fruit set and yield of mango cv Banganpalli. Souvenir 2010, 210.
8. Bhagwan A, Vijaya Krishna, Rajkumar M. Synergestic effects of plant growth regulators and fruit set improving chemicals on flowering, fruit set and yield of mango cv Alboonsa. Souvenir 2014, 210.
9. Bhowmick N, Banik BC. Influence of pre-harvest foliar application of growth regulators and micronutrients on mango cv. Himsagar. Indian Journal of Horticulture 2011;68(1):103-107.
10. Dhillon RS, Ahlawat KS, Pundeer JS. Botany of neem. Neem-A Treatise, 2008, 30-43.
11. Narong N, Sobon K. Review of biological and silvicultural characteristics of timber trees planted in Cambodia 2014.
12. Prabaharan P. Genetic improvement of neem (*Azadirachta indica* a. Juss.) For increased seed yield, oil and azadirachtin contents. Ph.D. Thesis in Tamil Nadu Agricultural University, Coimbatore 2020.
13. Sajjad Y, Jaskani MJ, Ashraf MY, Qasim M, Ahmad R. Response of morphological and physiological growth attributes to foliar application of plant growth regulators in gladiolus' white prosperity'. Pakistan Journal of Agricultural Science 2014.
14. Subbaiah, Venkata K, Reddy NN, Padmavathamma AS, Reddy MLN, Dorajee Rao AVD, Manjula R, Reddy AGK. Effect of paclobutrazol on hermaphrodite flowers, leaf chlorophyll. Journal of Horticultural Sciences 2018;7(04):2018.
15. Sudha R, Balamohan TN, Soorianathasundaram K. Effect of foliar spray of nitrogenous chemicals on flowering, fruit set and yield in mango (*Mangifera indica* L.) cv. Alphonso. Journal of Horticultural Sciences 2012;7(2):190-193.
16. Suman M, Sangma PD, Meghawal DR, Sahu OP. Effect of plant growth regulators on fruit crops. Journal of Pharmacognosy and Phytochemistry 2017;6(2):331-337.
17. Tandom R. Reproductive biology of Azadirachta indica (Meliaceae), a medicinal tree species from arid zones. Plant Species Biology 2011;26(1):116-123.
18. Teto AA, Charles P, Laubscher PA, Ndakidemi, Matimati I. Paclobutrazol retards vegetative growth in hydroponically-cultured *Leonotis leonurus* (L.) R. Br. Lamiaceae for a multipurpose flowering potted plant. South African Journal of Botany 2016;106:67-70.
19. Viradia RR, Singh SP. Quality production of cut roses cv. Gladiator as influenced by nutrient, plant density and water management. Journal of Ornamental Horticulture, 2004;7(3, 4):171-176.
20. Wang P, Singh V, Xu L, Johnston DB, Rausch KD, Tumbleson ME. Comparison of enzymatic (E-Mill) and conventional dry-grind corn processes using a granular starch hydrolyzing enzyme. Cereal chemistry 2005;82(6): 734-738.
21. Yadav JS, Wholey MH, Kuntz RE, Fayad P, Katzen BT, Mishkel GJ, Ouriel K. Protected carotid-artery stenting versus endarterectomy in high-risk patients. New England Journal of Medicine 2004;351(15):1493-1501.