Effect of growth promoters and fertilizers on growth and yield of patchouli (*Pogostemon cablin* Benth) under Asana [*Bridelia retusa* (L) A Juss]-based agroforestry system

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ABSTRACT

An experiment was conducted at the research farm of AICRP on Agroforestry, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra during 2021-22 to study the effect of growth promoters and fertilizers on growth and yield of patchouli under Asana [*Bridelia retusa* (L) A Juss]-based agroforestry system. Significantly maximum plant height of patchouli (65.53 cm) was observed in T_7 (IBA @ 1,500 ppm + GA_3 @ 1,500 ppm + *Azotobacter* @ 15 kg/ha) followed by T_6 (GA_3 @ 1,500 ppm + *Azotoacter* @ 15 kg/ha) (62.40 cm) and T_5 (IBA @ 1,500 ppm +*Azotobacter* @ 15 kg/ha) (59.83 cm). Maximum number of branches/plant (6.53, 6.47 and 6.40) was observed in T_7, T_6 and T_5 respectively, which were found to be at par. Maximum number of leaves/plant (57.10) and collar diameter (13.37 mm) were observed in T_7. Significantly maximum fresh foliage yield (25.79 and 22.96 q/ha) was recorded in T_7 and T_6 respectively. Dry foliage yield was highest in T_7 (10.02 q/ha) and T_6 (9.59 q/ha) and T_3 (GA_3 @ 1,500 ppm) (8.66 q/ha), the three being at par.

Keyword: Patchouli; GA; IBA; biofertilizers; Asana

INTRODUCTION

Asana [*Bridelia retusa* (L) A Juss has long been used in Indian folk medicine to treat broad spectrum of diseases such as liver diseases, for removal of urinary concretion, inflammatory diseases etc (Ghawate et al 2015). It is a very popular, multipurpose and highly nutritious agroforestry fodder species which is widely grown in silvopasture agroforestry system. This system is intensively managed for both forest products and forage, providing both short- and long-term income sources.

Patchouli (*Pogostemon cablin* Benth) is a partial shade loving plant and Asana provides partial shade throughout the season to any intercrop grown under Asana-based agroforestry system. Amongst the medicinal and aromatic plants as an intercrop under agroforestry system, patchouli is one of the important tropical, perennial, bushy herbaceous and most suitable plants under Asana-based agroforestry system in Konkan region of Maharshtra. Patchouli was originated from Philippines and now is cultivated in countries like China, Indonesia, Malaysia, Thailand, Mauritius, West Africa, Vietnam and India.

Plant growth regulators play an important role in the plant growth, number of essential oil storage structures and biosynthesis of essential oil which conclusively can alter and improve the quality and quantity of essential oil. Patchouli produces patchouli oil which is in high demand in the fragrance and perfume industry at both national and international markets. Patchouli herb possesses many therapeutic properties and is widely used in the fragrance industries.

In traditional medicinal practices, it is used to treat cold, headache, fever, nausea, vomiting, diarrhea, abdominal pain, insect and snake bites. In aromatherapy, patchouli oil is used to relieve depression, stress, calm nerves, control appetite and to improve sexual interest. Till now, more than 140 compounds including terpenoids, phytosterols, flavonoids, organic

acids, lignins, alkaloids, glycosides, alcohols and aldehydes have been isolated and identified from patchouli. However, some of the traditional uses need to be verified and may require standardizing and authenticating the bioactivity of purified compounds through scientific methods.

Cultivation of patchouli in suitable agroforestry species can also be important to get maximum profit (Kumar et al 2016). As per the farmers and pharmacutical industrial demand, patchouli is an intercrop grown under Asana-based agroforestry system to achieve the goal of doubling farmers' income and getting more sustainable yield; its cultivation particularly in Konkan coastal belt of Maharashtra.

MATERIAL and METHODS

The field experiment was conducted at the research farm of AICRP on Agroforestry, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra during 2021-22. The experimental plot soil was well drained and levelled as well as uniformed in topography having lateritic soil with good drainage.

The experiment was laid out in randomised block design (RBD) with eight treatments viz T_1 (NPK @ 200:50:50 kg/ha), T_2 (IBA @ 1,500 ppm), T_3 (GA_3 @ 1,500 ppm), T_4 (*Azotobacter* @ 15 kg/ha), T_5 (IBA @ 1,500 ppm + *Azotobacter* @ 15 kg/ha), T_6 (GA_3 @ 1,500 ppm + *Azotoacter* @ 15 kg/ha), T_7 (IBA @ 1,500 ppm + GA_3 @ 1,500 ppm + *Azotobacter* @ 15 kg/ha) and T_8 (Absolute control) replicated thrice. Saplings of patchouli were planted at 60 cm x 60 cm spacing under 10-year old Asana plantation planted at a spacing of 5 x 5 m^2. All the observations were recorded as per the standard procedure. The obtained results were statistically analysed and appropriately intercepted as per Panse and Sukhatme (1967).

RESULTS and DISCUSSION

The data on the effect of various treatments on the growth and yield parameters of patchouli under Asana-based agroforestry system are presented in Table 1.

Plant height: Significantly maximum plant height of patchouli (65.53 cm) was observed in T_7 (IBA @ 1,500 ppm + GA_3 @ 1,500 ppm + *Azotobacter* @ 15 kg/ha) followed by T_6 (GA_3 @ 1,500 ppm + *Azotoacter* @ 15 kg/ha) (62.40 cm) and T_5 (IBA @ 1,500 ppm + *Azotobacter* @ 15 kg/ha) (59.83 cm) and lowest in treatment T_8 (Absolute control) (42.70 cm). Bhaskar et al (1997), Duhan et al (1978) and Jadhav et al (2003) recorded maximum plant height of patchouli under NAA and GA_3 treatment.

Number of branches/plant: Maximum number of branches/plant (6.53, 6.47 and 6.40) was observed in T_7, T_6 and T_5 respectively which were found to be at par. Minimum branches were recorded in T_8 (3.30). Misra (1995) and Gul et al (2006) reported that the increase in the number of nodes, branches, green leaves and essential oil yield of shade-grown patchouli was recorded under foliar application of GA_3.

Table 1. Effect of different treatments on growth and yield of patchouli under Asana-based agroforestry system

Treatment	Height (cm)	Number of branches/plant	Number of leaves/plant	Collar diameter (mm)	Fresh foliage (q/ha)	Dry foliage (q/ha)
T_1	57.63	5.53	38.63	6.10	15.04	6.59
T_2	58.10	5.63	40.77	6.17	16.79	7.35
T_3	58.87	6.00	41.17	7.23	19.93	8.66
T_4	59.33	6.23	43.13	7.30	13.58	6.56
T_5	59.83	6.40	46.87	8.27	14.86	6.27
T_6	62.40	6.47	51.43	9.33	22.96	9.59
T_7	65.53	6.53	57.10	13.37	25.79	10.02
T_8	42.70	3.30	28.60	4.43	9.02	4.29
Mean	58.05	5.76	43.46	7.78	17.24	7.41
SE(m)±	0.2	0.07	0.2331	0.28	1.32	0.57
$CD_{0.05}$	0.5	0.21	0.7071	0.55	4.96	1.73

T_1 (NPK @ 200:50:50 kg/ha), T_2 (IBA @ 1,500 ppm), T_3 (GA_3 @ 1,500 ppm), T_4 (*Azotobacter* @ 15 kg/ha), T_5 (IBA @ 1,500 ppm +*Azotobacter* @ 15 kg/ha), T_6 (GA_3 @ 1,500 ppm + *Azotoacter* @ 15 kg/ha), T_7 (IBA @ 1,500 ppm + GA_3 @ 1,500 ppm + *Azotobacter* @ 15 kg/ha) and T_8 (Absolute control)

Number of leaves/plant: Maximum number of leaves/plant (57.10) was observed in T_7 followed by T_6 (51.43) and T_5 (46.87) and minimum in T_8 (28.60). Similar results were recorded by Krishnamoorthy and Madalageri (2000) and Sharifuzzaman et al (2011).

Collar diameter: Maximum collar diameter (13.37 mm) was observed by T_7 followed by T_6 (9.33 mm) and T_5 (8.27 mm) and lowest in treatment T_8 (4.43 mm). Kumar et al (2014) and Jadhav et al (2003) reported that IBA increased the size of patchouli stem.

Yield of patchouli: Significantly maximum fresh foliage yield (25.79 and 22.96 q/ha) was recorded in T_7 and T_6 respectively, which were at par, whereas, the lowest was recorded in T_8 (9.02 q/ha) and T_4 (13.58 q/ha), the two being at par. Dry foliage yield was highest in T_7 (10.02 q/ha) and T_6 (9.59 q/ha) and T_3 (GA_3 @ 1,500 ppm) (8.66 q/ha), the three being at par. Maheshwari et al (1991) and Jadhav et al (2003) reported that application of IBA @ 1,500 ppm resulted in maximum leaves, shoot length, leaf area and plant biomass of patchouli.

CONCLUSION

The treatment comprising IBA @ 1,500 ppm + GA_3 @ 1,500 ppm + *Azotobacter* @ 15 kg/ha resulted in maximum plant height (65.53 cm), number of leaves per plant (57.10) and collar diameter (13.37 mm) which was significantly superior to all other treatments. This treatment was also superior in increasing number of branches per plant and fresh and dry foliage along with other treatments. Thus this treatment could be recommended to grow patchouli under Asana-based agroforestry system.

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