Comparative study of different rapid multiplication methods in black pepper (*Piper nigrum* L.) cv. Panniyur - 1

Abstract

The present investigation entitled, "Comparative study of different rapid multiplication methods in black pepper (*Piper nigrum* L.) cv. Panniyur - 1" was conducted during the year 2023-2024 at the Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Dapoli, Dr. B. S. K. K. V., Dapoli, Dist. Ratnagiri (M.S.), India. The experiment was conducted in randomized block design with seven treatments namely T_1: Raised bed method, T_2: Soil mound method, T_3: Wooden log method, T_4: Serpentine method, T_5: Split halves of PVC method, T_6: Modified serpentine method, T_7: Trench method and each treatment was replicated four time. Among the various treatments studied, the treatment T_4 (Serpentine method) recorded maximum number of cuttings per harvest, total number of cuttings harvested per year, sprouting percentage at 30 days after planting (DAP), survival percentage at 45 DAP and the highest B:C ratio (2.37) was also observed in serpentine method.

Keywords: Black pepper, rooted cuttings, rapid propagation, multiplication, techniques

Introduction

Black pepper (*Piper nigrum* L.) belongs to the family Piperaceae and is a perennial export oriented spice crop in India. It is gaining popularity worldwide as an indispensable food adjunct due to its unique pungency and associated flavour. It is regarded as "King of Spices" and "Black Gold" it having enormous socio-economic importance (Bhat *et al.*, 1995)[3]. Pepper crop is native to South Asia and historical records reveal that pepper is originated in South India. Black pepper has spicy taste is mainly due to the present of a compound piperine that is a pungent alkaloid that enhance the bioavailability of various structurally and therapeutically diverse drugs (Khajuria *et al.*, 2002)[6]. Black pepper includes 5-9% of piperine, a pungent alkaloid, as its main bioactive chemical compound (Jiang, 2019)[4]. Piperine comprises of four isomers namely piperine, chavicine, isopiperine and isochavicine (Ahmad *et al.*, 2012)[1].

Black pepper has the ability to reproduce both vegetatively and through seeds. Seed propagation requires a significant amount of time and effort due to their high sterility and low viability in the post-fertilization stages. They have a modest number of offspring (Ravindran, 2000)[10]. Furthermore, plants derived from different vines must exhibit variability in growth patterns and productivity (Khan *et al.*, 2021; Philip *et al.*, 1992)[7] [9]. As a result, commercial production is boosted by the adoption of vegetative propagation techniques. Although black

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pepper can be propagated through layering, cuttings, rooted cutting, grafting and budding for industrial cultivation (Thangaselvabal *et al.*, 2008)[11].

The different rapid multiplication methods such as raised bed method, soil mound method, wooden log method, serpentine method, split halves of PVC method, modified serpentine method and trench method of black pepper used in present study for quicker propagation of black pepper plants, leading to mass multiplication production within a shorter time frame. It can reduce the overall cost of production by minimizing the time and resources required for propagation, such as labours and materials. By rapidly multiplying plants, growers can preserve the genetic diversity of black pepper varieties, ensuring a more resilient and adaptable crop in the face of pests, diseases and environmental changes. These methods enable growers to scale up their operations more efficiently, meeting the demands of a growing market for black pepper. With rapid multiplications, growers can maintain a steady supply of black pepper throughout the year, reducing seasonal fluctuations in availability and prices. Controlled environments used in rapid multiplication methods can help minimize the risk of disease transmission, ensuring that propagated plants are healthy and disease-free. These rapid multiplication methods allow for the propagation of black pepper in diverse environmental conditions, making cultivation feasible in regions where traditional propagation methods not be suitable. Overall, rapid multiplication methods play vital role in enhancing the efficiency, sustainability and profitability of black pepper cultivation.

Material and methods

The field experiment was carried out at the Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri during the year 2023-2024. The experiment was executed in Randomized Block Design (RBD) with seven treatments and four replications. Five black pepper rooted cuttings were selected randomly from replication of each treatment to record observations. Average of five cuttings was computed for further statistical analysis. In each treatment, 20 cuttings were planted in every replication. The maximum number of cuttings per harvest, total number of cuttings obtained per year, sprouting percentage at 30 DAP and survival percentage at 45 DAP were recorded at appropriate stages during investigation period. The data was statistically analysed as method suggested by Panse and Sukhatme (1995)[9].

Results and Discussion

Number of cuttings per harvest

The data pertaining to number of cuttings in different rapid multiplication methods in black pepper are presented in Table 1 and graphically depicted in Fig. 1. From the data, it is observed

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that there was significant difference among the treatments with respect to number of cuttings per harvest.

The number of cuttings obtained at first and second harvest differed significantly among the various treatments. The highest number of cuttings at first harvest (55.60) and second (63.37) harvest were observed in treatment T_4 (Serpentine method) which was significantly superior over rest of the treatments at first and second harvest. The minimum number of cuttings of at first (30.61) and second (35.94) harvest were recorded in treatment T_7 (Trench method).

In present experiment, the highest number of cuttings per harvest were observed in serpentine method. It might be due to each node is gently pressed into the polybags with the help of a clip, as the rooted cuttings grow and produce nodes these nodes eventually come in contact with soil and potting media such as vermicompost, allowing for roots at that specific point.

Similar results reported by Kadake (2019)[5] observed that the serpentine method produced maximum numbers of black pepper cuttings at first (52.35) and second (52.95) harvest. Whereas, the raised bed method produced the minimum number of cuttings at first (33.15) and second (35.80) harvest, respectively.

Total number of cuttings

The perusal of data on total number of cuttings obtained in different rapid multiplication methods of black pepper are presented in Table 1 and depicted in Fig 1.

From the data it is observed that there was significant difference among the different treatments in respect of total number of cuttings obtained per year. Significantly the highest numbers of cuttings (118.97) harvested in a year recorded in treatment T_4 *i.e.* serpentine method which was significantly superior over rest of the treatments. However, the lowest total number of cuttings were recorded in treatment T_7 *i.e.* Trench method (66.55).

In present study, the highest total number of cuttings per plant were obtained in serpentine method. It might be due to the rapid development of roots at each node when pressed and fixed in (soil + vermicompost) media that results in a greater number of cuttings every year.

The present findings were similar to the research findings reported by Thapa *et al.* (2017)[12] stated that the serpentine technique of multiplication produced on an average 60 cuttings from per mother plant per year. Bhai *et al*. (2018)[2] concluded that the maximum numbers of black pepper cuttings produced in nine months from a single plant in variety "IISR Malabar Excel" was produced (59.60) cuttings followed by "IISR Thevam" (51.00) and "IISR Shakthi" (23.00) by serpentine method. Kadake (2019)[5] observed that the serpentine method produced the highest

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number of cuttings per year (105.30). The lowest number of cuttings were obtained from raised bed method (68.95).

Table 1: Effect of different rapid multiplication methods in black pepper on production of number of rooted cuttings

Treatments	Number of cuttings per harvest		Total number cuttings obtained per year
	1st harvest 150 DAP	2nd harvest 120 days after 1st harvest	
T_1 - Raised bed (Control)	39.50	46.68	86.18
T_2 - Soil mound	45.65	49.19	94.84
T_3 - Wooden log	34.53	37.40	71.93
T_4 - Serpentine	55.60	63.37	118.97
T_5 - Split halves of PVC	35.74	42.46	78.20
T_6 - Modified serpentine	50.16	52.98	103.14
T_7 - Trench method	30.61	35.94	66.55
Mean	**41.68**	**46.86**	**88.54**
Range	**30.61-55.60**	**35.94-63.37**	**66.55-118.97**
S. Em.±	**1.65**	**2.40**	**5.20**
C. D. at 5%	**4.92**	**7.14**	**15.46**
'F' test	**SIG**	**SIG**	**SIG**

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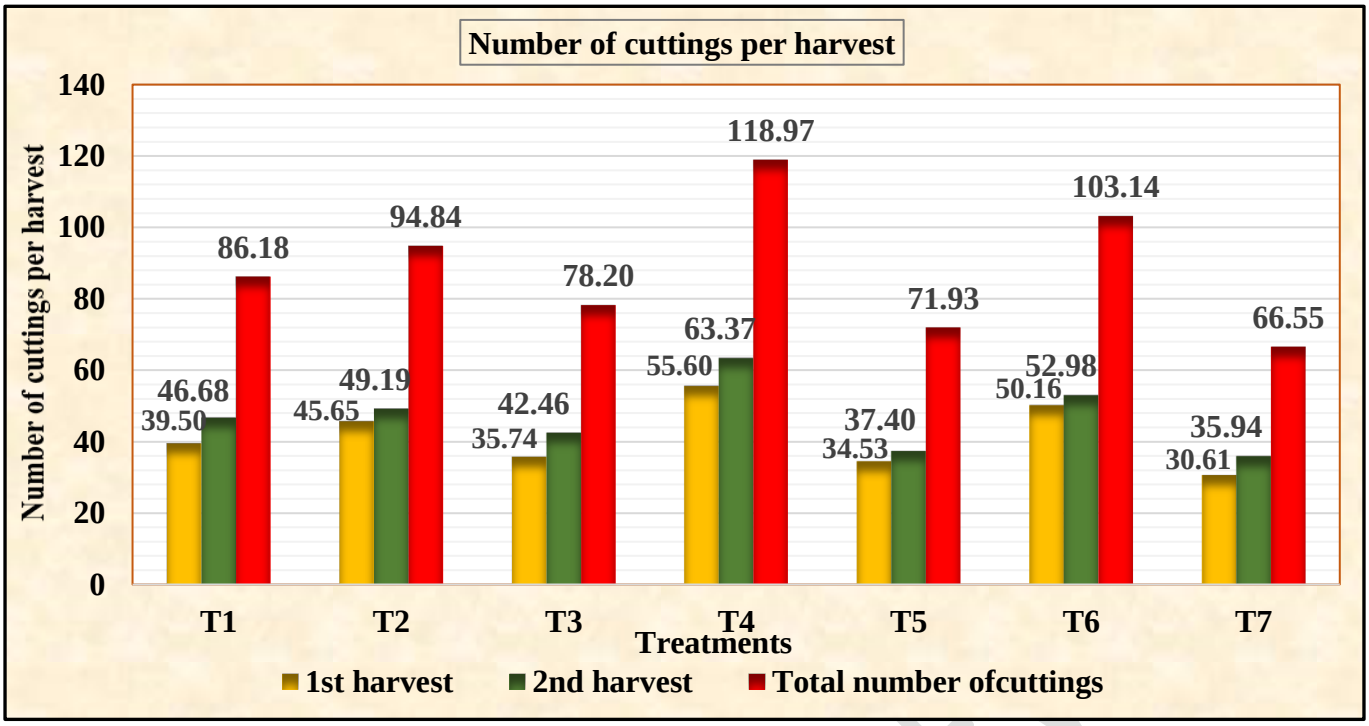

Fig. 1 Effect of different rapid multiplication methods of black pepper on production of rooted cuttings

Sprouting percentage

The data regarding on sprouting percentage in various rapid multiplication methods in black pepper are presented in Table 2 and graphically represented in Fig 2.

At 30 DAP sprouting percentage at first and second harvest differed significantly among treatments. Significantly the highest sprouting percentage was recorded in treatment T_4 - Serpentine method at first (93.22 %) and second (97.45 %) harvest which was statistically superior over rest of treatments. However, the lowest sprouting percentage were observed in treatment T_7 - Trench method (63.64 % and 69.70 %) at first and second harvest, respectively.

In present investigation, the highest sprouting percentage was observed in serpentine method. It may be due to the root volume plays an important role in the sprouting of cuttings. Use of soil and vermicompost media resulted in increasing porosity, water holding capacity, low shrinkage, low bulk density and slow biodegradation of the medium along with availability of nutrients resulted in increase in root volume and dry matter content of root. The weather condition during experimental period was also congenial for increasing the cell activity for formation of root, which resulted in higher sprouting percent.

The results are accordance with the findings of Kadake (2019)[5] revealed that, the highest percentage of sprouting in black pepper cuttings was recorded at first (96.59 %) and second (94.32 %) harvest in treatment T_4 - Serpentine method. Whereas, the lowest percentage of sprouting was recorded in treatment T_1 - Raised bed method at first (77.73 %) and second (78.37 %) harvest.

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Table 2: Effect of different rapid multiplication methods on sprouting percentage per rooted cuttings in black pepper

Sprouting Percentage (30 DAP)		
Treatments	**1st harvest 150 DAP**	**2nd harvest 120 days after 1st harvest**
T_1 - Raised bed (Control)	76.74	81.39
T_2 - Soil mound	78.72	82.97
T_3 - Wooden log	66.19	74.64
T_4 - Serpentine	93.22	97.45
T_5 - Split halves of PVC	67.94	78.20
T_6 - Modified serpentine	82.52	84.46
T_7 - Trench method	63.64	69.70
Mean	**75.56**	**81.25**
Range	**63.64-93.22**	**69.70-97.45**
S. Em.±	**3.49**	**4.37**
C. D. at 5%	**10.38**	**12.98**
'F' test	**SIG**	**SIG**

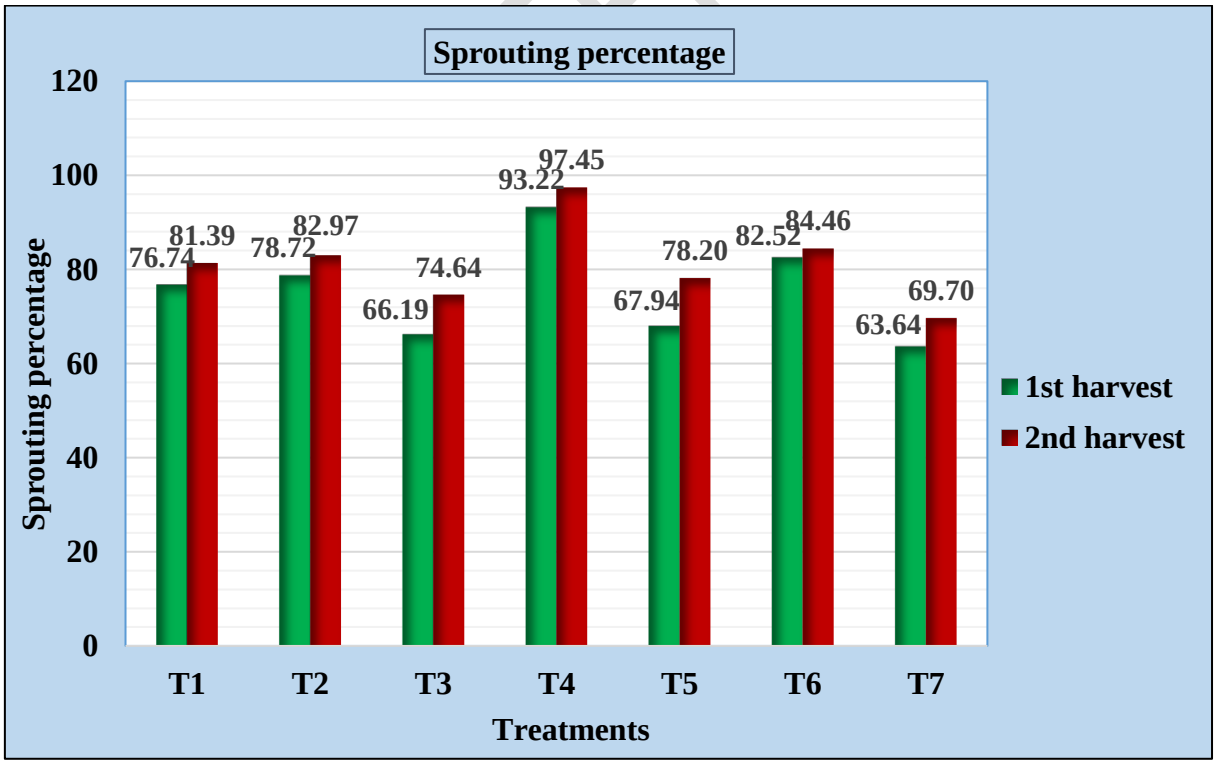

Fig. 2 Effect of different rapid multiplication methods on sprouting percentage per rooted cuttings of black pepper

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Survival percentage

The data pertaining to the survival percentage of rooted cuttings of black pepper in different rapid multiplication methods are presented in Table 3 and graphically represented in Fig. 3.

The highest survival percentage of rooted cuttings at first harvest (92.37%) and second harvest (96.61%) were observed in treatment T_4 (Serpentine method). Whereas, the lowest survival percentage (60.61%) and (68.18%) was recorded in treatment T_7 (Trench method) at first and second harvest, respectively.

In present investigation, the serpentine method (T_4) had the highest survival percentage at both first and second harvest. It is possible that vermicompost supplied physical conditions and adequate nutrients to rooted cuttings, resulting in improved metabolic and physiological activities along with good development of root system.

The results are in conformity with findings reported by Kadake (2019)[5] that the maximum survival percentage of black pepper cuttings at first harvest (93.58) and second harvest (91.83) in serpentine method. Thapa *et al.* (2021)[13] reported that the maximum survivability (93.00 % and 88.33 %, respectively) at 30 and 90 days after cuttings in Panniyur -1 by serpentine layering method; these findings are in agreement with present results.

Table 3: Effect of different rapid multiplication methods in black pepper on survival percentage

Survival Percentage (45 DAP)		
Treatments	**1st harvest 150 DAP**	**2nd harvest 120 days after 1st harvest**
T_1 - Raised bed (Control)	69.76	75.58
T_2 - Soil mound	73.40	77.65
T_3 - Wooden log	63.38	70.42
T_4 - Serpentine	92.37	96.61
T_5 - Split halves of PVC	65.38	71.79
T_6 - Modified serpentine	78.64	83.49
T_7 - Trench method	60.61	68.18
Mean	**71.91**	**77.67**
Range	**60.61-92.37**	**68.18-96.61**
S. Em.±	**3.40**	**4.11**
C. D. at 5%	**10.10**	**12.22**
'F' test	**SIG**	**SIG**

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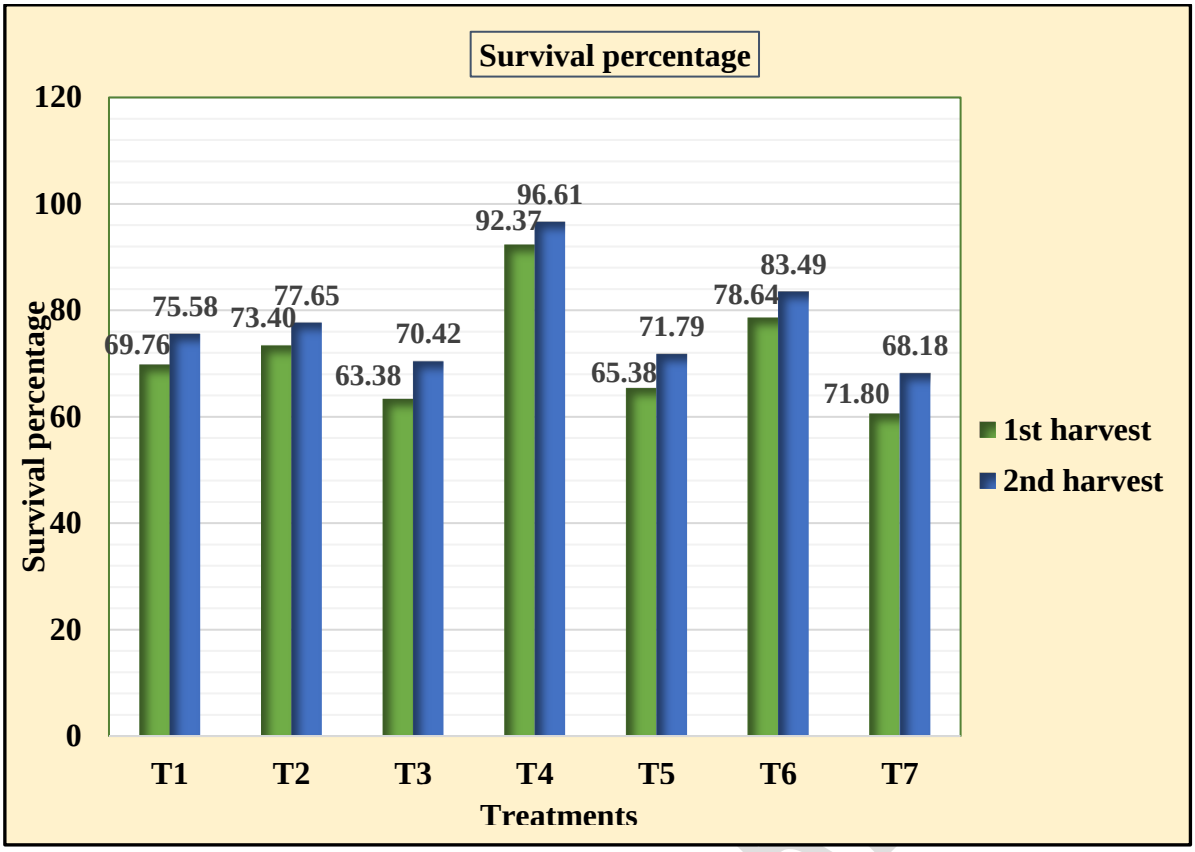

Fig. 3 Effect of different rapid multiplication methods on survival percentage per rooted cuttings in black pepper

Conclusion

On the basis of current study, it can be concluded that, the maximum number of cuttings per harvest, total number of cuttings obtained per year, sprouting percentage and survival percentage was observed in treatment T_4 (Serpentine method). So far as growth performance, quality and production of total number of sampling per year is concerned, serpentine method hence, which was found best for rapid multiplication in black pepper.

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