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Influence of Growing Media and *Aloe vera* (L.) Burm. f. Extract on the Establishment of Black Pepper Vine Cuttings

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Abstract: Cultivating black pepper for culinary preparation and medicinal purposes is challenged by inadequate planting materials for field establishment. Seed propagation does not produce true-to-type seedlings, while vegetative methods have poor survival rates. Modern technology and imported growing media are too expensive for resource-poor farmers. Hence, there is a need to investigate locally available rooting media and hormones (*Aloe vera*-Av) on black pepper vine establishment. In a 2×9 factorial experiment, two rooting hormone (+Av and -Av) and nine growing media: T1 (100% Rice hulls), T2 (75% Rice hulls + 25% Soil), T3 (50% Rice hulls + 50% Soil), T4 (25% Rice hulls + 75% Soil), T5 (100% Sawdust), T6 (75% Sawdust + 25% Soil), T7 (50% Sawdust + 50% Soil), T8 (25% Sawdust + 75% Soil) and T9 (100% Soil) were evaluated in completely randomised design replicated four times. The +Av treated vine-cutting had significantly lesser days for sprouting and more vine length than the other treatments but were similar to T9. The T1 did not support the vine-cutting establishment. The interactions of Av with growing media were significant for the parameters observed. Days to sprouting ranged from 10.33 (T6 × +Av) to 22.00 days (T2 × - Av and T4 × -Av). The 75% Sawdust + 25% Soil, 25% Sawdust + 75% Soil and 100% Soil media with *Aloe vera* gel promotes black pepper establishment.

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Keywords: Aloe vera extract; growing media; days to sprouting; vegetative propagation

1. Introduction

Piper nigrum L. is a medicinally and commercially important crop often called "black pepper" because of the colour of its peppercorn. It is also considered the "king of spices" because of its huge international market trade (Mathew et al., 2006; Srinivasan, 2007). the crop is native to tropical regions of Central and Western Africa. It is known as `Uziza` in Igbo and `Iyere` in Yoruba, other common names are Benins pepper, Guinea pepper and False cubeb. The fruits of the black pepper contain 1.02% volatile oil and 5-9% alkaloids, of which the major ones are piperine, chavicine, piperidine, piperetine and resin (Navickene et al., 2000). The various parts of the plants are used for food, income generation and medicine (Juliani et al, 2013).

Black pepper is grown in the tropical region, with world production at 812673.57 tonnes of peppercorns in 2022, of which 12.69% was from Africa. West African countries like Burkina Faso, Niger, Ghana and Benin contributed 82.55% of the total production from Africa (FAO, 2022). Despite the versatility of this spice, adequate attention has not been paid to its cultivation in Nigeria. The crop is semi-cultivated in countries like Nigeria (Alaje et al., 2022). The plant can be propagated through seeds or vegetative means. However, due to its heterozygous nature, the seed does not produce through-to-type seedlings, lacks uniformity and is often harvested and dried to generate income by the farmer (Verma, 2018). The vegetative means of propagation are difficult to establish on the field due to the prolonged period of vine establishment (Ee and Shang, 2017). The multiplication of stem cuttings through tissue culture is too expensive for the resource-limiting farmers that constitute the larger percentage of farmers cultivating the crop. The use of hormones to promote black pepper rooting is reported (Alaje et al., 2022). Also, rooting cuttings through soilless technology is a modern approach to managing vines, but they are expensive and require trained personnel (Gruda, 2019; Hamilton et al., 2023). Successes in cuttings are achieved by root initiation and growth as well as shoot formation. There are several factors affecting adventitious root formation in stem cuttings, these include, genotype, physiological, diseases and the growth media used for the cuttings (Daba et al. 2017). The establishment of black pepper is tough, it is necessary to employ appropriate growth media and plant growth hormone ideal for its production.

Growing media are all those solid materials, which alone or in mixtures can guarantee better

conditions than agricultural soils (Haska et al., 2022). There are many commercial growing media used to raise seedlings, but it is difficult for the common growers, especially from developing countries to bear the high cost (Prisa and Caro, 2023). Therefore, there is a need to establish appropriate and low-cost growing media that will promote seedling establishment, survival and growth. Such growing medium would provide sufficient anchorage, serve as a reservoir for nutrients and water, allow oxygen diffusion to the roots and permit gaseous exchange between the roots and atmosphere outside (Abad et al., 2008). Similarly, such materials should be cheap and locally available waste materials that can be used in the replacement of expensive growing media. Growing media like press mud, rice husk, bagasse, wheat straw, farm yard manure, and coco peat are available for the production of quality horticultural crops (Prisa and Caro, 2023). A growing medium that is pathogens-free ensures healthy nursery seedlings (Ahmad et al., 2004).

The infection of vine-cutting pathogens during establishment in the nursery is a factor in the success or failure of the exercise. Most studies have reported the use of rooting and disinfectants such as hormones and Aloe vera (Av) independently for the establishment of different crops (Trivedi et al., 2019; Vidanapathirana et al., 2023). Aloe vera solution was used as a growth hormone. Aloe vera can be used as a growth hormone in plants due to its natural antibacterial and antifungal properties and is relatively cheap to obtain (Vidanapathirana et al., 2023). When applied topically to plants, A. vera can help prevent and control the growth of harmful pathogens, including bacteria, fungi and viruses, which can reduce the risk of disease and promote healthy plant growth (Kasozi et al., 2019). Additionally, A. vera can also help to soothe and heal any wounds or damage to the plant caused during the cutting of the vine and may promote pest infestation, thus improving plant health and growth (Arulselvi et al., 2020). The effect of A. vera could also delaying sprouting due to environmental factor that limits cell multiplication for growth. Also, bud initiation is associated with metabolic processes in the plant which can reduce the cofactors that are needed for root growth (Shiade et al., 2024). However, limited information is available on the interaction of locally sourced growing media with A. vera. Hence, there is a need for locally available and suitable growing media that could improve the survival of black pepper vine for field establishment. The objective of this study was to determine the effect of different growing media and A. vera on the establishment and growth of black pepper.

Location of the Experiment

The experiment was carried out between March to September 2021 at the screenhouse of the Department of Crop and Horticultural Sciences, Faculty of Agriculture, University of Ibadan, Oyo state, Nigeria. The coordinates were 7.34°N and 3.89°E with an altitude of 227 metres above sea level. **Experimental Design and Treatments**

The experiment was in a 2×9 factorial arrangement of two rooting hormone (+Av and -Av) and nine growing media in different proportions: T1 (100% Rice hulls), T2 (75% Rice hulls + 25% Soil), T3 (50% Rice hulls + 50% Soil), T4 (25% Rice hulls + 75% Soil), T5 (100% Sawdust), T6 (75% Sawdust + 25% Soil), T7 (50% Sawdust + 50% Soil), T8 (25% Sawdust + 75% Soil) and T9 (100% Soil) were evaluated in completely randomised design replicated four times.

Pre-planting Operations

The media were mixed in different proportions and bagged in perforated black polythene bags of 27 cm x 25 cm and a thickness of 1 mm used in nursery establishment.

Collection of Planting Materials

The black pepper vines were collected from the collection maintained at the Department of Crop and Horticultural Sciences, University of Ibadan, Nigeria. The vines were cut and planted the same day at the greenhouse of the Department. *A. vera* extract (the transparent mucilaginous jelly substance in the parenchyma cell) was obtained from the screenhouse area of the Department.

Collection of Growing Media and *Aloe vera* solution

The growing media (sawdust, rice hull and topsoil) were collected from different locations. Sawdust was collected at the Bodija sawmill, the rice hull was collected at Bodija market in Ibadan and the top soil was collected from Parry Road at the University of Ibadan campus. Ten grammes of *A. vera* extract was mixed with 100 ml of water to form *A. vera* solution.

Planting

The polythene bags were irrigated for two weeks to stabilise the media before planting the vines. The black pepper vine cuttings with three nodes were planted one per polythene bag. Before planting, the lower part of the vine was immersed in a disinfectant (*Aloe vera*). At planting, a groove wider than the size of the cutting was made at the centre of the media in other not to rub off the solution when inserting the vine. The polythene bags were irrigated at two days intervals until emergence.

Data Collection

1. Materials and Method

Data collected were days for sprouting, number of leaves, vine length and the leaf area. The leaf area was estimated by the length and the breadth multiplied with a constant value of 0.61 (Ibrahim et al., 1985). Data were measured at two-week intervals. The number of leaves was counted, while leaf area and vine length were measured with the metre rule, and the days to sprouting were taken for the appearance of young leaves at the inter-node of the vines.

Statistical Analysis

The data measured were subjected to Analysis of Variance using Statistical Analysis System (SAS) software version 9.0. Significantly different means were separated with the Duncan Multiple Range Test at $\alpha_{0.05}$.

The Av-treated cutting had significantly fewer days to sprouting compared with the cuttings not treated (Table 1). The days to sprouting in the black pepper vine were significantly affected by Rice hull (RH), Sawdust (SD), Soil (S) and their interactions with Av solution. The vine cuttings under 75% RH + 25% S with A, and 50% RH + 50% S with A treatments had significantly higher days to sprouting than the cuttings under 75% SD + 25% S with A, and 50% SD + 50% S with A. Across the media used, Av-treated cuttings had comparatively shorter days to sprout than the treatments without Av solution applied, except with the 100% Rice husk. Also, rice hull mixtures had relatively higher days to sprout compared to sawdust mixtures. The cuttings under 100% S with A sprouted 5 days earlier than 100% S without A, while the 100% SD did not sprout.

2. Results

Influence of *Aloe vera* (Av) and growing media on the days to sprouting of black pepper

Fable 1. Effect of Aloe vera and	growing media solution o	n days to sprout of black	pepper vine cuttings

Treatment	Days to sprouting	% Survival
Aloe vera		
without Av	14.97b	51.94b
with Av	18.72a	83.33a
Aloe vera \times growing media		
100% RH without Av	18.30a-c	0.00e
75% RH + 25% Soil without Av	22.00a	25.00d
50% RH + 50% Soil without Av	22.00a	50.00c
25% RH + 75% Soil without Av	20.00а-с	100.00a
100% Sawdust without Av	15.00a-c	50.00c
75% Sawdust + 25% Soil without Av	18.00a-c	50.00c
50% Sawdust + 50% Soil without Av	17.00a-c	50.00c
25% Sawdust + 75% Soil without Av	17.30а-с	50.00c
100% Soil without Av	20.30а-с	100.00a
100% RH with Av	21.00ab	100.00a
75% RH + 25% Soil with Av	19.00a-c	75.00b
50% RH + 50% Soil with Av	16.00a-c	75.00b
25% RH + 75% Soil with Av	15.33а-с	75.00b
100% Sawdust with A	15.00a-c	25.00d
75% Sawdust + 25% Soil with Av	10.33c	100.00a
50% Sawdust + 50% Soil with Av	12.30bc	100.00a
25% Sawdust + 75% Soil with Av	11.00c	100.00a
100% Soil with Av	15.30а-с	100.00a

RH = Rice husk; Av = *Aloe vera*; Mean values followed by a similar letter(s) are not significantly different at P < 0.05, according to Duncan's Multiple Range Test.

The effect of *Aloe vera* and growing media on established cuttings

The percentage of survived cuttings as affected by Aloe vera treatment was significant (Table 1). The percentage of survival of cuttings treated with Aloe vera increased significantly compared to the untreated cuttings. The cuttings under 100% RH without Aloe vera did not survive, while all the cuttings under 100% RH with Aloe vera survived. Only the 25% RH + 75% Soil and 100% Soil under the no Aloe vera treatment had 100% sprouted cuttings. However, the rice hull mixtures and 100% SD had cuttings that were lower than 100 in the treatments with *Aloe vera*.

Influences of *Aloe vera* solution and growing media on the leaf area (cm^2) of Black Pepper

The Aloe vera treatment significantly increased the black pepper leaf area compared to vines from the untreated pots throughout the observation periods (Table 2). The leaf area observed in Aloe veratreated cutting from 4 to 20 WAP was significantly higher than the untreated cuttings. The influence of growing media on the leaf area of black pepper was significantly different throughout the observation periods. The leaf area increases with the increase in weeks, however, there was a decline in the leaf area of seedlings established with 50% RH + 50% Soil with A and 25% RH + 75% S with A after 16 weeks. The leaf area at 4 WAP differed significantly among treatments and ranged from 0.00 (100% RH without A) to 2.00 cm (75% SD + 25% Soil with A). The cuttings established with 100% Soil without A had significantly higher leaf area than the other treatments at 8 WAP, except 100% Soil without A and 75% SD + 25% Soil with A. At 12 WAP, the leaf area varied significantly among treatments with the highest and lowest values observed under the 100% Soil with A and 100% RH without A treatments, respectively. The plants established with T9 (100% S without A) and T18 (100% S with A) were significantly higher in leaf area at 16 and 20 WAS. However, those established with 75% RH +25% S without A had significantly the

lowest leaf area. No leaf area was observed for 100% RH without A treatment.

Effects of *Aloe vera* solution and growing media on the number of leaves of black pepper vine

At 4 WAP, treating cuttings with Aloe vera improved the black pepper number of leaves by 36.23% compared to the untreated (Table 3). At 8 to 20 WAP, Aloe vera-treated cuttings had a significantly higher number of leaves than the untreated cuttings. After sprouting, the number of leaves in black pepper increases as the number of weeks increases for all the treatments other than cuttings under 100% Rice husk. There were significant differences among the treatments for a number of leaves throughout the observation periods, except at 4 WAP. At 8 WAP, the number of leaves differs significantly among treatments with the highest values observed in the plants established with 100% Soil with A and lowest under 75% RH + 25% Soil without A and 50% RH + 50% Soil without A treatments. At 12, 16 and 20 WAP, the highest number of leaves was observed in plants established with 100% Soil with A. However, the lowest number of leaves at 12, 16 and 20 WAP were observed in 75% RH + 25% Soil without A and 100% SD with A-treated plants. Comparatively, the mixtures of RH or SD with Aloe vera had a higher number of leaves than the no Aloe vera-treated plants.

	4 WAP	8 WAP	12 WAP	16 WAP	20 WAP
Aloe vera					
Without A	0.58b	4.87b	7.33b	10.42b	11.52b
With A	1.28a	10.09a	13.60a	17.24a	19.10a
Aloe vera × growing media					
T1	0.00e	0.00e	0.00e	0.00f	0.00f
T2	0.30de	1.53de	3.1de	3.83d-f	2.75f
T3	0.60b-e	2.75de	3.30de	6.25c-f	6.75c-f
T4	1.2a-e	9.8b-e	15.17а-с	22.53ab	19.8b-e
T5	0.50c-e	2.50de	2.50de	7.00c-f	5.25d-f
T6	1.2a-e	8.6b-e	10.4b-e	13.7a-f	14.00b-f
Τ7	0.30de	3.30с-е	6.08с-е	8.7b-f	9.60c-f
Τ8	0.8a-e	4.35с-е	8.33b-e	11.8a-f	13.0b-f
Т9	1.52a-d	13.03a-c	18.13ab	25.33a	35.25a
T10	0.7а-е	9.35b-e	13.35b-d	20.85ac	20.30b-d
T11	1.40a-d	7.75b-e	12.0b-d	18.50a-d	19.20b-e
T12	1.55ab	10.5bcd	13.70cd	17.3а-е	14.7b-f
T13	1.0a-e	8.08b-e	9.25b-e	15.1a-e	13.0b-f
T14	0.33ce	3.25с-е	1.83ef	2.75ef	4.57ef
T15	2.00a	14.63ab	19.18ab	22.23ab	25.70ab
T16	1.0a-e	10.10b-e	13.38b-d	16.5a-e	19.02b-e
T17	1.60a-c	7.33b-e	12.58b-d	15.40а-е	21.23a-c
T18	1.85ab	19.83a	24.45a	26.45a	34.75a

Table 2. Influence of *Aloe vera* solution and growing media on the leaf area (cm²) of black pepper vines

T1 = 100% RH without A; T2 = 75% RH + 25% Soil without A; T3 = 50% RH + 50% Soil without A; T4 = 25% RH+75% Soil without A; T5 = 100% SD without A; T6 = 75% SD + 25% Soil without A; T7 = 50% SD + 50% Soil without A; T8 = 25% SD + 75% Soil without A; T9 = 100% Soil without A; T10 = 100% RH with A; T11 = 75% RH + 25% Soil with A; T12 = 50% RH + 50% Soil with A; T13 = 25% RH + 75% S with A; T14 = 100% SD with A; T15 = 75% SD + 25% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% SOil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% Soil with A; T16 = 50% SD + 50% Soil with A; T17 = 25% SD + 75% Soil with A; T18 = 100% SO + 50% Soil with A; T18 = 100% SD + 50% Soil with A; T10 = 100% SD + 50% Soil with A; T10 = 100% SD + 50% Soil with A; T10 = 100% SD + 50% Soil with A; T10 = 100% SD + 50% SOI + 50%

Influence of growth media on the final vine length (cm) of black pepper

The final vine length was significantly higher in seedlings treated with *Aloe vera* solution compared to the untreated (Table 4). The 100% Soil with *Aloe vera* solution had significantly longer black pepper vine than the other treatments. The final vine length of black pepper were similar for enhanced by the use of 100% Soil with *Aloe vera*, 100% Soil without *Aloe vera* solution and 100% Rice husk with *Aloe vera* solution. The utilisation of 100% Rice husk without *A. vera* did not have vine length, while the 100% Rice husk with *A. vera* had. Comparably, the interactions involving *A. vera* with the different growing media mixtures had had longer vines than those without *A. vera* treatment.

Table 5. The humber of leaves of black pepper as affected	by moe ver	a solution a	ind growing	meana	
Treatments	4 WAP	8 WAP	12 WAP	16 WAP	20 WAP
Aloe vera					
without A	0.44	0.61b	0.92b	1.56b	1.94b
with A	0.69	1.33a	1.47a	2.50a	3.33a
Aloe vera \times growing media					
T1	0.00b	0.00c	0.00d	0.00e	0.00f
T2	0.25ab	0.25bc	0.25cd	0.50de	0.75ef
Т3	0.25ab	0.25bc	1.00b-d	1.75b-e	1.50ef
T4	1.00a	1.00a-c	1.33b-d	3.33bc	5.33bc
Т5	0.25ab	0.75a-c	1.25b-d	2.25b-e	2.00d-f
Тб	0.67ab	1.33a-c	1.67b-e	1.67с-е	1.67ef
Τ7	0.25ab	0.05bc	0.50cd	0.75с-е	1.00ef
Т8	0.50ab	0.50cb	0.50cd	1.00с-е	1.50ef
Т9	1.00a	1.00a-c	2.50ab	4.25ab	6.50ab
T10	0.75ab	1.25a-c	1.75a-d	3.25b-d	5.25b-d
T11	0.75ab	1.25a-c	2.00a-c	2.50b-e	3.00c-f
T12	1.00a	1.25a-c	1.25b-c	2.00b-e	2.50c-f
T13	0.50ab	1.75ab	1.50a-d	2.25b-e	3.75b-e
T14	0.25ab	0.50bc	0.50cd	0.50de	0.50ef
T15	1.00a	1.00a-c	1.75b-e	2.00b-e	2.00d-f
T16	0.50ab	1.75ab	1.00b-d	2.00b-e	1.75ef
T17	0.50ab	1.00a-c	1.00b-d	2.00b-e	2.75c-f
T18	1.00a	2 259	3.00a	6.00a	8 50a

Table 3. The number of leaves of black pepper as affected by Aloe vera solution and growing media

T1 = 100% RH without Av; T2 = 75% RH + 25% Soil without Av; T3 = 50% RH + 50% Soil without Av; T4 = 25% RH+75% Soil without Av; T5 = 100% SD without Avv; T6 = 75% SD + 25% Soil without A; T7 = 50% SD + 50% Soil without A; T8 = 25% SD + 75% Soil without Av; T9 = 100% Soil without Av; T10 = 100% RH with Av; T11 = 75% RH + 25% Soil with Av; T12 = 50% RH + 50% Soil with Av; T13 = 25% RH + 75% S with Av; T14 = 100% SD with Av; T15 = 75% SD + 25% Soil with Av; T16 = 50% SD + 50% Soil with Av; T17 = 25% SD + 75% Soil with Av; T16 = 50% SD + 50% Soil with Av; T17 = 25% SD + 75% Soil with Av; T18 = 100% Soil with Av; WAP = weeks After Planting; RH = Rice husk; SD = Sawdust; Av = *Aloe vera*; Mean values within the same column, followed by similar letter(s) are not significantly different at P < 0.05, according to Duncan's Multiple Range Test

Table 4. Effects of Aloe vera and growth media on the final vine length of black pepper

Treatments	Final vine length (cm)
Aloe vera	
without Aloe vera	9.18b
with Aloe vera	17.62a
Aloe vera \times growing media	
100% RH without Av	0.00e
75% RH + 25% S without Av	3.60de
50% RH + 50% S without Av	6.60de
25% RH + 75% S without Av	17.25b-d
100% SD without Av	5.25de
75% SD + 25% S without Av	7.75с-е
50% SD + 50% S without Av	5.60de
25% SD + 75% S without Av	7.75с-е
100% S without Av	28.80b
100% RH with Av	22.73bc

75% RH + 25% S with Av	18.00b-d
50% RH + 50% S with Av	11.58с-е
25% RH + 75% S with Av	12.85с-е
100% SD with Av	6.75de
75% SD + 25% S with Av	10.43с-е
50% SD + 50% S with Av	12.18с-е
25% SD + 75% S with Av	15.60b-e
100% S with Av	48.50a

RH = Rice husk; Av = *Aloe vera*; Mean values followed by a similar letter(s) are not significantly different at P < 0.05, according to Duncan's Multiple Range Test.

3. Discussion

Effect of *Aloe vera* solution and growing media on days to sprout of black pepper vine cuttings

Sprouting in crops indicates the initiation of growth by the dormant bud at the leaf axil, which gradually develops into a leaf. The initiation of growth by the axillary bud is triggered by removing the factor responsible for Paradormancy, endodormancy or ecodormancy (Ponraj and Theres, 2020). The results indicated that A. vera extract causes a reduction in black pepper sprouting. The effects of A. vera extract on germination have been positive, The different growth media with and without A. vera solution affect the earliness and lateness of sprouting in black pepper. The 75% SD + 25% S with A had the earliest sprouting days in black pepper 10 days after planting. This could be based on attributes like good structure that favoured sprouting. Growth media with medium textured soil are well drained, well aerated and have better water retention which is a prerequisite for early sprouting (Shah et al., 2006). The 25% SD + 75% S with A sprouted earlier at 11 days, followed by T7 (50% SD + 50% S with A) at 12 days. Rice husk along with soil helped to improve the structural and textural properties of the soil and the availability of nutrients and moisture easily for plant growth and root establishment. Late sprouting caused by different mixtures of RH with or without A could be attributed to low water retention and nutrient retention. Rice husk will support the late sprouting of the black pepper cuttings due to its low water retention capacity to enhance root formation (Akinrinola and Onadeko, 2023). Also, the late sprouting from 100% S without A, 25% SD+75% S without A, 50% SD+50% S without A. 75% SD+25% S without Α. 25% RH + 75% S without A, 50% RH + 50% S without A, 75% RH +25% S without A, 50% RH + 50% S with A and 75% RH +25% S with A could also be attributed to poor aeration and water logging conditions.

Survival of cuttings

The survival of *A. vera*-treated cutting was substantially higher than the untreated cuttings. The variation could be attributed to improvement in the

rooting of the system and reduction in the likely infection of the cutting at planting by *A. vera* extract (Bahgat et al., 2023). The total failure in the 100% RH without A treatment confirmed that the cuttings were unable to root, despite having sprouted. The inability of the cuttings to acquire nutrients from the medium must have led to complete mortality of the cuttings. The survival of cutting under 100% RH with Aloe vera treatment confirmed the value of Aloe vera for enhancing crop development (Alkuwayti et al., 2022). Comparatively, the Aloe vera improved the survival of cuttings irrespective of either RH or SD medium. **Influence of growing media and** *Aloe vera* **solution**

on the leaf area (cm^2) of black pepper vine cuttings

The leaves are the photosynthetic apparatus to intercept light rays from the sun (Kochetova et al., 2022). This apparatus is used to accumulate and assimilate for growth. The improvement in the plants treated with A. vera over the untreated substantiates the role of Aloe vera in root development for improved nutrition. This finding confirmed Zhakata and Abduel (2021) that the enhancement in root formation facilitates the development of fever tea. The changes in leaf area observed in black pepper cuttings are a result of the various media treatments. Plant established with 100% S with A and 100% S without A has the highest leaf area and best performance from weeks 8 to 20 after planting this is due to the rich in organic matter and humus triggered the production of photo-synthetically functional leaves and leaves produce more quantity of enzymes which accelerate cell division and expansion of leaves (Kochetova et al., 2022). T9 had a higher leaf area value compared to T18 because of the application of the Aloe vera extract, the use of *Aloe vera* extract in black pepper vine has shown results in improving plant growth and health. A study carried out by (kasozi et al., 2019) showed that the application of *Aloe vera* solution significantly reduced the incidence and severity of fusarium wilt in plants. The plants established with 75% RH + 25% S without Av and 100% RH without A had lower leaf areas. The result could be attributed to the fact that the rice husk didn't decompose very well, thus, leading to nutrients immobilisation by soil microbes. Therefore,

the ability of the plant root to absorbed nutrients are limited.

Effects of growing media and *Aloe vera* solution on the final vine length (cm) of black pepper vine cuttings

The final vine length in the A. vera-treated cuttings was higher than the untreated. This substantiated the efficacy of A. vera in promoting root development in plant. The result corroborated Mirihagalla and Fernando (2020) that A. vera induce rooting, thus facilitates the ability of the established plant to acquire water and nutrients than the untreated cuttings. The differences observed in the final vine length of black pepper vine cuttings are affected by different growth media and A. vera. It was observed that the plant established with T18: (Soil 100% without A. vera) has the highest vine length with a value of 48.5 followed by T9: Topsoil 100% with A. vera with a value of 28.8. Physiological activity in successful cuttings produces new shoots and leaves, and more numbers of shoots and leaves trigger the process of photosynthesis which results in the accumulation of energy and, simultaneously availability of moisture nutrients through media (Ikram et al., 2012). Hence more increase in height was obtained in media top soil 100% without Aloe vera, T9 had a high final vine length due to the use of Aloe vera. A study carried out by (Arulselvi et al., 2020) showed that the application of Aloe vera significantly increased the vine length compared to the control group. Compared with those that established, the plant established with T2 (25% Soil+ 75% Rice husk without A. vera) has the lowest vine length this may be due to unfavourable condition in the medium and the absence of A. vera to act as a mediator. Consequently, there was restriction in the ability of the plant to the root to absorbed nutrients water supply required for vegetative growth.

4. Conclusion

The results obtained showed that *Aloe vera* solution did not promote sprouting but improved the survival and growth of black pepper cutting in the nursery. The cuttings raise with 75% Soil + 25% Rice husk sprouted earlier, which was the appropriate growth medium for the nursery establishment of black pepper under screen house conditions. The use of 100% Soil improved the subsequent growth of black pepper concerning number of leaves, leaf area and vine length over 22 weeks in the nursery. 100% Rice husk is not a suitable medium to be used in the establishment of black pepper, since the medium did not encourage rooting.

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References:

- 1. Abad M, Noguera P, Puchades R, Maqulelra A, Noguera V. Physio-chemical and chemical properties of some coconut dusts for use as a peat substitute for containerized ornamental plants. Bioresource Technology 2002;82: 241-245.
- Ahmad W, Junaid M, Nafees M, Farooq M, Saleem BA. Effect of pruning severity on growth behaviour of spur and bunch morphology of grapes (*Vitis vinifera*) cv. Perlette. International Journal of Agriculture and Biology 2004;6: 160-161.
- Akinrinola TB, Onadeko RA. Performance of black pepper cuttings as influenced by growing media. Chilean Journal of Agricultural and Animal Sciences 2023;39(3): 256-265. https://doi.org/10.29393/CHJAA39-22PBTO20022
- Alaje VI, Omoayena EJ, Morakinyo DA. Rooting potentials of juvenile and mature stem cuttings of *Ceiba pentandra* (L.) Gaertn using different hormones. International Journal of Applied Science and Technology 2019;8: 23-8.
- Alkuwayti MA, Aldayel MF, Yap Y, El-Sherif F. Exogenous application of aloe vera leaf extract improves silybin content in *Silybum marianum* L. by up-regulating chalcone synthase gene. Agriculture 2022;12(10): 1649. https://doi.org/10.3390/agriculture12101649
- 6. Arulselvi R, Thanarangan G, Marimuthu T. Effect of *Aloe Vera* on growth and yield of black pepper (*Piper nigrum* L.) Plants. International Journal of Chemical Studies 2020;8(5): 876-880.
- Bahgat A, Dahab AA, Elhakem A, Gururani MA, El-Sharafy SR. Integrated action of rhizobacteria with *aloe vera* and moringa leaf extracts improves defense mechanisms in *Hibiscus sabdariffa* L. cultivated in saline soil. Plants 2023;12(21): 3684. https://doi.org/10.3390/plants12213684
- Daba T, Kifelew H, Hailemichael G, Getachew W. Insect pests infesting black pepper (*Piper nigrum* L.) in southwestern part of Ethiopia. African Journal of Agricultural Research 2017;12: 1817–23.
- Ee KP, Shang CY. Novel farming innovation for high production of black pepper (*Piper nigrum* L.) planting materials. Journal of Agricultural Science and Technology B 2017;7: 301-308 doi: 10.17265/2161 6264/2017.05.001

- 10. FAO FAOSTAT Statistical data base. 2022. https://www.fao.org/faostat/en/#data/QCL 18/09/2024
- Gruda NS. Increasing sustainability of growing media constituents and stand-alone substrates in soilless culture systems. Agronomy 2019;9(6): 298. https://doi.org/10.3390/agronomy9060298
- Haska OJA, Söylemez S, Sarhan TZ. Effect of different organic growing mediums and application of biofertilizer in organic seedling production. World Journal of Advanced Research and Reviews 2022;13(2): 252–263.
- Kochetova GV, Avercheva OV, Bassarskaya EM, Zhigalova TV. Light quality as a driver of photosynthetic apparatus development. Biophysical Reviews 2022;14(4): 779-803. https://doi.org/10.1007/s12551-022-00985-z
- Juliani HR, Koroch AR, Giordano L, Amekuse L, Koffa S, Asante-Dartey J, Simon JE. *Piper guineense* (Piperaceae): Chemistry, traditional uses, and functional properties of west African black pepper. In: African Natural Plant Products Volume II: Discoveries and Challenges in Chem, Health, and Nutrition (ACS Symposium Series; Vol. 1127). American Chemical Society. 2013; 33-48. https://doi.org/10.1021/bk-2013-1127.ch003
- 17. Mathew PJ, Mathew PM, Kumar V. Multivariate analysis in fifty cultivars/landraces of black pepper (*Piper nigrum* L.) occurring in Kerala, India. Revista Brasileira de Plantas Medicinais 2006;8: 180-185.
- Navickene HMD, Alecio AC, Kato MJ, Bolzani VS, Young MCM, Cavalheiro AJ, Furlan M. Antifungal amides from Piper hispidum and Piper tuberculatum. Phytochemistry 2000;55: 621-626.
- Ponraj U, Theres K. Keep a distance to be different: Axillary buds initiating at a distance from the shoot apical meristem are crucial for the perennial lifestyle of *Arabis alpina*. New Phytologist 2020;227(1): 116-131. https://doi.org/10.1111/nph.16512
- Prisa D, Caro S. Alternative substrates in the cultivation of ornamental and vegetable plants. GSC Biological and Pharmaceutical Sciences 2023;24(01): 209–220. https://doi.org/10.30574/gscbps.2023.24.1.0268
- 21. Shiade SRG, Zand-Silakhoor A, Fathi A, Rahimi R, Minkina T, Rajput VD, Zulfiqar U,

https://wjarr.com/sites/default/files/WJARR-2021-0747.pdf

- Ikram S, Habib U. Khalid N. Effect of different potting combinations on growth and vase life of tuberose. Pakistan Journal of Agricultural Sciences 2012;49(2): 121-125
- Kasozi WN, Wasukira A, Kalyango F, Salazar-Manrique R. Efficacy of Aloe Vera gel as a potential bio-fungicide against Fusarium wilt in black pepper. Journal of Agricultural Technology 2019;15(1): 31-44.

Chaudhary T. Plant metabolites and signaling pathways in response to biotic and abiotic stresses: Exploring bio stimulant applications. Plant Stress 2024;12: 100454. https://doi.org/10.1016/j.stress.2024.100454

- 22. Srinivasan K. Black pepper and its pungent principle-piperine: a review of diverse physiological effects. Critical Reviews in Food Science and Nutrition 2007;47: 735-748.
- 23. Verma VM. Plant propagation and commercial cultivation in the micronesian region: challenges and measures for sustainable black pepper production. Combined Proceedings IPPS 2018;68: 254-266.
- 24. Trivedi R, Sangur R, Bathala LR, Srivastava S, Madhav S, Chaubey P. Evaluation of efficacy of *Aloe vera* as a disinfectant by immersion and spray methods on irreversible hydrocolloid impression material and its effect on the dimensional stability of resultant gypsum cast -An in vitro study. Journal of Medicine and Life 2019;12(4): 395-402. https://doi.org/10.25122/jml-2019-0050
- 25. Mirihagalla M, Fernando M. Effect of aloe vera gel for inducing rooting of stem cuttings and air layering of plants. Journal of Dry Zone Agriculture 2020;6(1): 13-26.
- Vidanapathirana NP, Rifnas LM, Sumanasekara HHN. Effects of different root inducing agents on cutting propagation of tea (*Camellia sinensis*). Annual Research and Review in Biology 2023;38: 30-37. 10.9734/arrb/2023/v38i630590hal-04194486
- 27. Zhakata TC, Abduel TM. Aloe vera gel and rooting of fever tea (Lippia javanica). International Journal of Plant Pathology and Microbiology 2021;1(2): 53-56.

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