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Effect of Cutting Position and Growing Media on Rooting of Salad Cucumber (*Cucumis sativus* L.) Cuttings

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Abstract

The influence of cutting position and growing media on the rooting of salad cucumber lateral branches was investigated at the Faculty of Agriculture, University of Ruhuna, Sri Lanka. A 2×3 Factorial Completely Randomized Design, including four replicates, was used to conduct the investigation. Cutting position (basal end and terminal end of the lateral branch) and growing media (coir dust, coir dust: sand (1:1) and sand) were considered as the two factors. Data were recorded as weight of cutting, length of cutting, number of roots per cutting, length of the longest root, fresh weight of roots and dry weight of roots one month after planting. ANOVA was used to analyze the data and SAS software was used to separate the means by the least significant difference (LSD) at a 5% probability level. According to the results, the weight of cutting, length of cutting, and fresh weight of roots resulted in an interaction effect. Basal end cuttings planted in coir dust media yielded the considerably highest fresh weight of roots (0.507 g). In comparison,terminal end cuttings planted in coir dust media recorded the significantly highest weight (13.500 g) and length of cutting (46.125 cm). Cutting position and growing media had a substantial impact on the length of the longest root and the dry weight of roots. The significantly highest length of the longest root (3.432 cm) and dry weight of roots (0.109 g) were observed in basal end cuttings planted in coir dust media. The number of roots per cutting was significantly high in coir dust (3.530) and coir dust: sand (1:1) (3.036) media. Increasing the vine length results in higher yield than increasing the number and weight of roots because salad cucumber has a short life cycle and bears fruits at the vine nodes. Thus, terminal ends of the lateral branches of salad cucumber can be utilized to effectively root in a coir dust medium to obtain planting material for the subsequent crop cycle.

Keywords: cutting position, lateral branches, salad cucumber

Introduction

Salad cucumber (*Cucumis sativus* L.) is the most commonly grown vegetable crop under protected houses for higher economic value in off-season cultivation. It generates parthenocarpic edible fruits. According to Kumar *et al*. (2020), parthenocarpy is very helpful for fruit development in environments such as protected houses, where good pollination and fertilization are not possible [1]. However, parthenocarpic lines must be maintained and multiplied by chemicals or plant growth regulators when parthenocarpic hybrids are produced. This requires the involvement of highly skilled individuals and the concurrent construction of protected structures to prevent contamination and deterioration [1]. Consequently, it is crucial to investigate alternative propagation techniques to produce salad cucumber plants successfully.

Cutting is one of the most often used techniques in the horticultural sector for vegetative plant growth [2]. It offers several benefits including low cost, limited space requirement, and quick and easy spread of chosen clones. Thus, cutting is, practical, efficient, and economically important [3]. Salad cucumber vines are trained on plant training threads as single-stems by removing lateral branches continuously to maximize vertical space utilization . Seeds propagate salad cucumber, and vegetative propagation is not widespread. These pruned lateral branches are usually considered as waste material [1]. However, growing hybrid salad cucumber by seeds is expensive due to high prices of the hybrid seeds. If those pruned lateral branches were used to plant, they would be of considerable commercial value and cost effective to the high prices of hybrid seeds. If those pruned lateral branches were used to plant, they would be of considerable commercial value and cost-effective for regeneration [4].

In addition, growing media plays a vital role in plant production. According to Rajkumar *et al*. (2017), soil-based growing media may be associated with the rapid loss of water from the medium [5]. Therefore, various organic and artificial growing media containing ingredients like peat, compost, or coconut coir have been found to be suitable substitutes. Further, a rooting medium which constitutes soil should contain 10 to 30 percent soil supplemented with organic materials to promote aeration and water flux while prolonging water retention for extended periods. Therefore, the current study was carried out to explore the potential of rooting of salad cucumber pruned lateral branches and minimise the costs incurred on purchasing salad cucumber hybrid seeds each time for a new crop cycle using different positions of salad cucumber cuttings and various soilless growing media.

Materials and Methods

This study was carried out in a shade house at the Faculty of Agriculture at the University of Ruhuna, Sri Lanka, to assess the impact of cutting position and growing media on the rooting of salad cucumber lateral branches. A 2×3 factorial completely randomized design with four replicates was used to conduct the study. Each replicate consisted of two cuttings. The two factors were cutting position (basal end and terminal end of the lateral branches) and growing media (coir dust, 1: 1 coir dust: sand and sand). Healthy lateral branches actively growing were selected from salad cucumber mother plants grown in a protected house to obtain cuttings for the present study. Lateral branches were removed using a sharp knife. Cuttings were prepared from the basal ends and terminal ends of lateral branches with 20 - 25 cm lengths with two nodes.

Leaves of the cuttings were removed by pulling them backwards and snapping the petioles of leaves. However, the buds of the terminal ends were not damaged. The initial weight of the cuttings was between 15–17 g. One inch of the cutting end was dipped into powdered rooting hormone, which constituted 0.3% of Indole 3–butyric acid. Cuttings were tapped lightly to knock off any excess hormone. Single propagators of growing media, each sized 35×15 cm^2 filled with 5-inch depth, were used for planting the cuttings. A pencil was pushed into the centre of the growing media to form a 1-inch depth hole. Hormone-applied cut ends of salad cucumber cuttings were planted into holes, and growing media around the cuttings were packed lightly. Single propagators were kept in a shade house. After one month, data were recorded on weight of cutting, length of cutting, number of roots per cutting, length of the longest root, fresh weight of roots and dry weight of roots. ANOVA was used for statistical analysis of the collected data, and means were separated at the 5% probability level based on the least significant difference (LSD) using Statistical Analysis Software (SAS) 9.1.3 version.

Results and Discussion

The results showed that cutting position and growing media had an interaction effect on cutting weight, length, and fresh weight of roots. The significantly highest weight and length of cutting were recorded when terminal end cuttings were planted in coir dust media (Figure 1), while cuttings taken from basal ends planted in coir dust media recorded the remarkably highest fresh weight of roots (Figure 2).

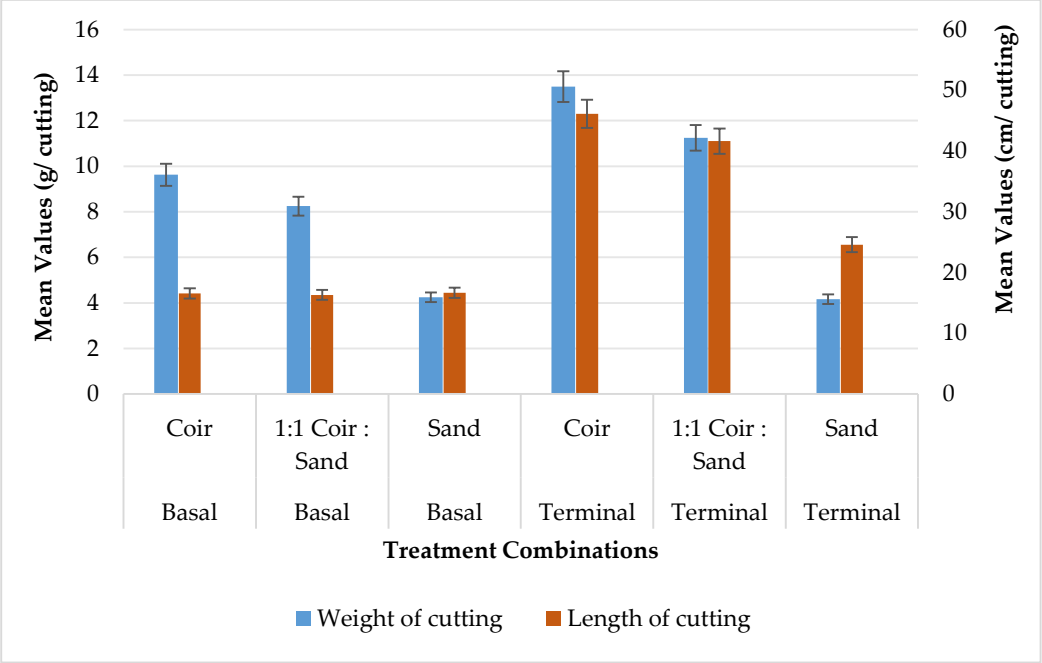

Figure 1. Weight and length of cuttings at different treatment combinations

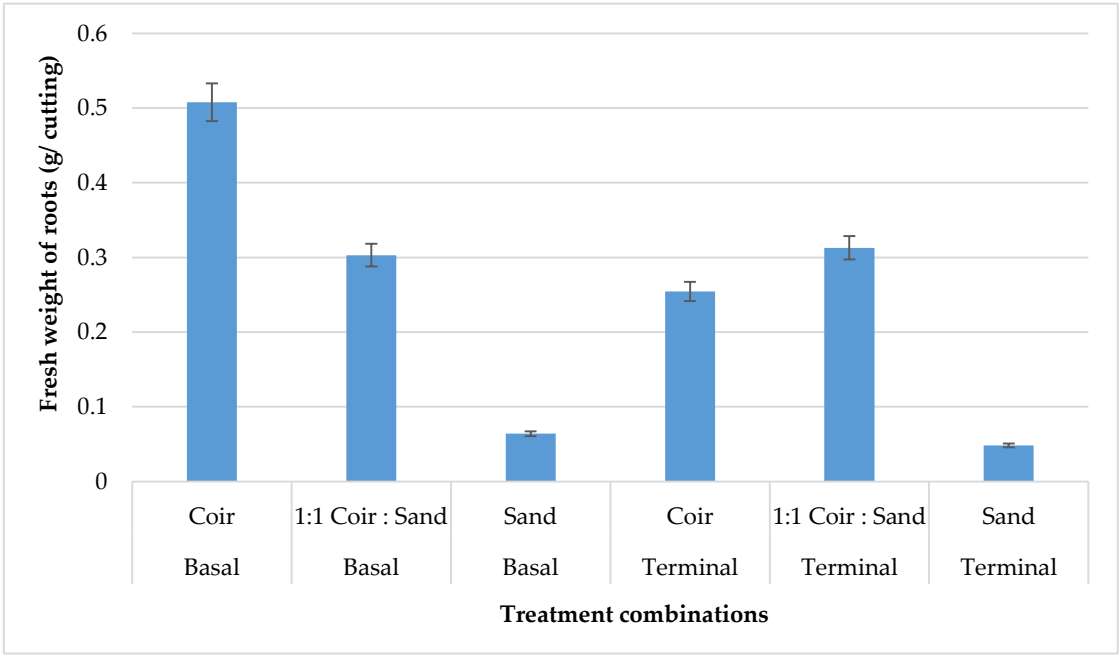

Figure 2. Fresh weight of roots at different treatment combinations

As mentioned by Jaleta *et al*. (2019), the type of growing media is vital for rooting and vegetative growth of cuttings. According to them, good growing media holds plant-available water, acts as a nutrient reservoir, facilitates gas exchange and gives plants a strong foundation. In addition, types of media have a considerable impact on rooting and vegetative growth of cuttings since the organic matter content and water retention capacity vary in different growing media. The type of cutting, growing conditions, the species, season of the year and the cost effectiveness of the medium constituents influence the suitability of a growing media as a rooting medium. A media which is light weighted, porous, free from pathogens and well drained is considered to be an optimum growing media. Thus, growing media is a crucial component of the propagation system since rooting capability varies according to the type of the medium used [3]. Farooq *et al*. (2018), also stated that rooting medium has a direct impact on the percentage and quality of rooting [6]. Moreover, Abebe (2017) declared that plant and root growth is influenced by both biological and physio-chemical properties of the growing media [7].

Therefore, rooting media is one of the most vital factors in production of rooted cuttings. Coir dust is a locally available commercial growing media in Sri Lanka. According to Nazari *et al*. (2011), many ornamental and agronomic crops have been tested with coir dust as a horticultural medium, with satisfactory results [8]. Rajkumar *et al*. (2017), also stated that cocopeat considerably improves the rooting in cuttings. An exemplary suitable potting medium must be inexpensive, simple to make and readily available [3]. As mentioned by Kumarasinghe *et al*. (2016), coconuts are heavily exploited for their kernel which serves as the basis for coconut oil [9]. The spongy pericarp (husk), which is left over after exploitation is frequently used as a raw material for coir fibre. Finally, fibre components from waste-grade coir may be sieved out with the leftover product being utilized to make coir dust. Plant growth substrates made from coir dust are produced in large quantities in Sri Lanka and are exported worldwide. Thus, coir dust can be easily found in Sri Lanka and is cheap as a growing media.

In addition, Hansen *et al.* (1986), has mentioned that where the cutting is located on the stock plant is an essential factor for adventitious root formation [10]. The author further stated that the influence of topophysis, often known as the cutting position influence is of great importance for subsequent shoot growth in vegetative propagation. In the present study, there is a positive effect from terminal end cuttings grown in coir dust media for length and weight of the shoots. These results agree with the findings of Jensen *et al*. (1967), who reported reduced shoot growth in cuttings from the basal position in *Schefflera arboricola* [11]. Hassanein (2013) stated that better shoot growth of terminal cuttings is associated with apical buds in terminal cuttings. In addition, Safeer (2013) observed *Plectranthus vettiveroides* top stem cuttings had a greater plant height than middle and base stem cuttings [12]. As mentioned by Solikin (2018) the shoot growth on the top stem cutting is fast and higher than other cutting positions as a result of higher auxin concentration in top stem cuttings [13].

However, basal end cuttings planted in coir dust medium produced the significantly highest fresh weight of roots. Jensen *et al*. (1967), further reported that cuttings taken from apical sites rooted slowly, generated fewer roots and had a lower percentage of rooting than cuttings taken from basal regions. Hartmann and Kester (1983) also reported that cuttings taken from the basal areas of a shoot often have the most potent most substantial rooting ability [14]. Pandey and Husen (2022) have reported that several economically significant plant species including *D. melanoxylon*, *D. Sissoo*, and *Ulmus villosa*

have shown better rooting ability in cuttings taken from the base region of the stem and according to them that is due to increase of soluble sugar at the shoot base [15]. As reported by Khursheed and Salih (2007), orange cuttings taken from the basal section of lateral shoots had a more substantial regeneration capacity than those taken from the apical ones [16]. They attributed this to the production of some root initials on the base area. Furthermore, Zalesny *et al*. (2003), found that the stool plant's basal region of the shoot exhibited nearly twice as much rooting as the middle and apical areas of populus [17]. This was attributed to variations in organogenic activity along the parental shoot's stem, higher carbohydrate storage and the initiation of preformed root primordia in basal region of the shoot.

When considering the length of the longest root and dry weight of roots, they were significantly affected by growing media and cutting position separately. Length of the longest root and dry weight of roots were found to be considerably greater in basal end cuttings planted in coir dust media (Figures 3 and 4).

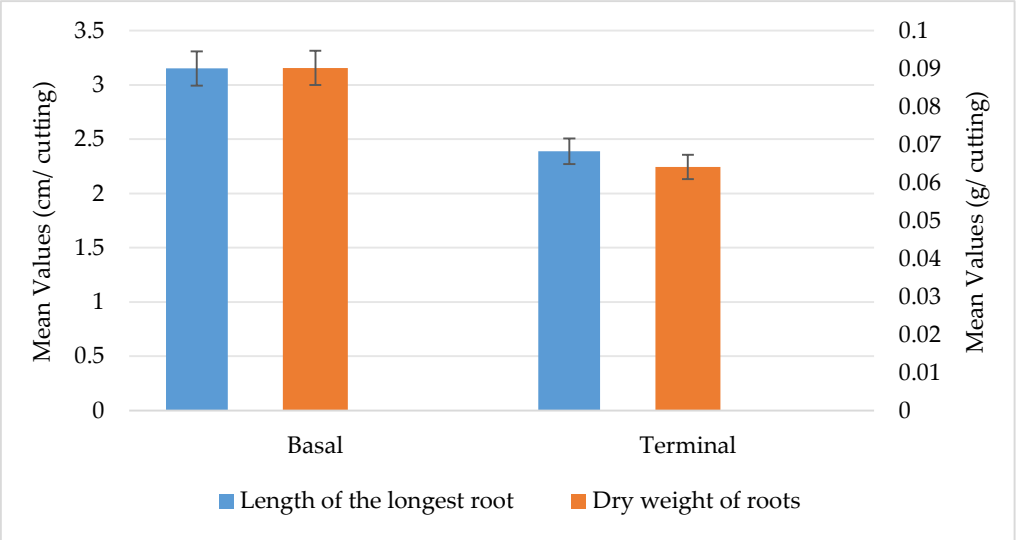

Figure 3. Length of the longest root and dry weight of roots as affected by cutting position

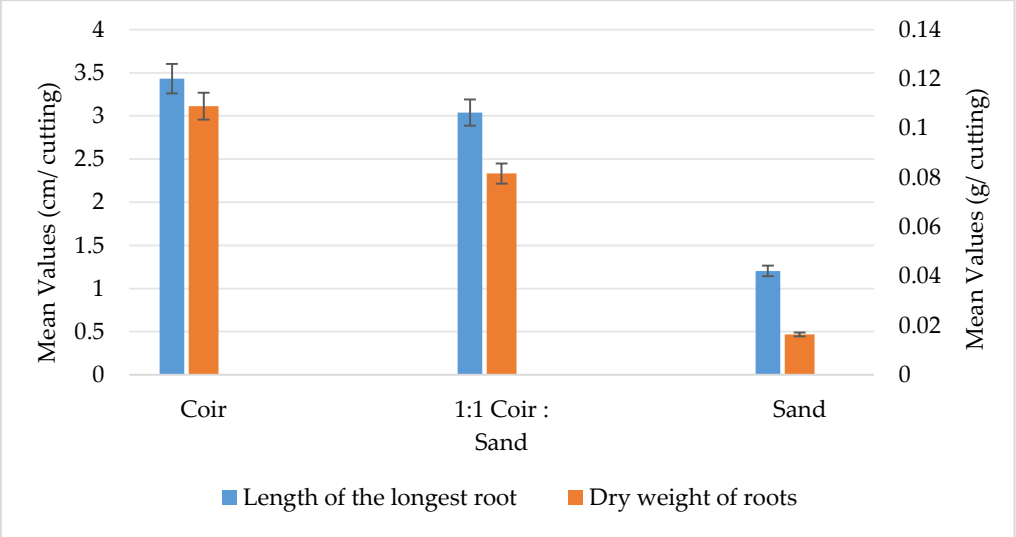

Figure 4. Length of the longest root and dry weight of roots as affected by growing media

When considering the number of roots per cutting, only the growing media had a considerable impact on number of roots per cutting (Figure 5).

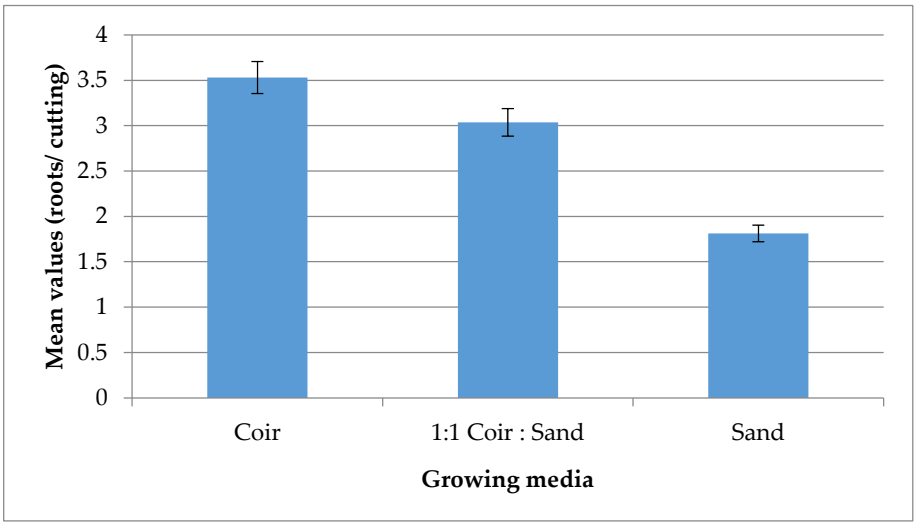

Figure 5. Number of roots as affected by growing media

Coir dust and 1 : 1 coir dust : sand growing mediums reported significantly higher number of roots per cutting than sole sand media. This may be associated with the features of coir media which include greater water-holding capacity and total pore space. When comparing coir dust media solely with 1 : 1 coir dust : sand media; the latter had also facilitated optimum moisture availability by coir dust and good aeration by sand. Swetha (2005) also obtained highest number of roots in Indian lavender grown in coir substrate with compared to soil. Further, Ansari (2013) mentioned that rooting percentage is directly influenced by the growing medium used [20].

Conclusion

Salad cucumber has a short life cycle and bears fruits in nodes of the vine. Therefore, increasing vine length may yield better than increasing the weight and number of roots. Terminal ends of salad cucumber lateral branches can be used for rooting effectively in coir dust media to obtain planting material for the next crop cycle of the same variety without having to pay for seeds.

Conflicts of Interest

The author declares no conflict of interest.

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