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Tatenda Chiyedza Zhakata
Africa University, Mutare, Zimbabwe

Mtaita Tuarira Abduel
Africa University, Mutare, Zimbabwe

Correspondence
Tatenda Chiyedza Zhakata
Africa University, Mutare, Zimbabwe

Aloe vera gel and rooting of fever tea *(Lippia javanica)*

Tatenda Chiyedza Zhakata and Mtaita Tuarira Abduel

Abstract
Fever tea *(Lippia javanica)* has gained popularity and harvested and harvested at an alarming rate because of its healing properties. The present study was conducted to identify the effect of different Aloe vera gel concentrations on root formation. Different aloe vera gel concentrations were used; 100%, 75% 25% and 0%. A completely randomized design was used and the six (6) treatments were replicated five times. Results were collected on days 5, 10, 15 and 20 on the number of cuttings that had formed shoots, the number of cuttings that had developed roots and the survival rate of the cuttings from the ones that had rooted and the ones that had formed shoots. It was concluded that there was no significant difference in rooting ($p<0.05$) for the different treatments. Numerically at day 20 and 75% aloe vera gel treatment had a higher rooting percentage as compared to the other 5 treatments. The influence of rooting treatment was significant ($p<0.05$) for the shooting percentage of fever tea cuttings. The number of cuttings that formed shoots increased as the days progressed. The highest number of cuttings that formed shoots were those treated with Seradix No 2. However, they did not differ significantly ($p>0.05$) with cuttings treated with 100% aloe vera gel. Therefore, aloe vera gel can be used to induce rooting and shooting properties.

Keywords: Aloe vera gel, Plant growth regulators, Rooting, Seradix No2

Introduction
Fever tea (*Lippia javanica)* belongs to the Fabaceae family. It is an indigenous plant occurring naturally in central, eastern, and southern Africa. It has also been recorded in the tropical Indian subcontinent. The species is native to Angola, Botswana, Central African Republic, Democratic Republic of Congo, Ethiopia, Kenya, Malawi, Mozambique, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zanzibar, and Zimbabwe. The plant is generally a woody shrub; growing up to two meters within three years if grown under favorable conditions. This plant is mainly found in the open veld, woodlands, plantations, scrub bushland, kopjes, ground beside roads, swampy ground and termite mounds.
Because of the shining virtues of the fever tea (*Lippia javanica)* plant, it is being used up at a faster rate than it is regenerating in nature necessitating the need to propagate the fever tea for its sustainability. Propagation through cuttings has been facilitated by the use of synthetic Plant Growth Regulators (PGRs) like Seradix which is expensive and difficult to access. The need to introduce other alternatives like the use of Aloe vera gel cannot be over-emphasized. Aloe vera gel, is a natural alternative root-inducing substance and firm plant establishment. Use of natural alternative compounds to induce rooting of cuttings will go a long way towards alleviating problems of rooting of cuttings in nurseries. Fernand (2020) [1] and Uddin, (2020) [5] has indicated that, aloe vera induces rooting in cutting and could be used to replace synthetic growth regulators. As limited studies and documentation of the effect of Aloe vera gel as a root-inducing substance is scanty, systematically designed experiments are needed to demonstrate the use of Aloe vera gel as a root-inducing substance. Using aloe vera gel as a natural rooting hormone will be environmentally friendly and a cheaper alternative to the use of synthetic rooting hormone. The gel can be homemade with no extra costs, meaning it can be used by small-holder farmers.

Materials and Methods
A total of 300 fever tea cuttings, aloe vera gel, sandy soils, water, Seradix No 2, Sterile knife, moist newspaper, plastic bags, and a sand bed were used for the study. The experiment was conducted at Africa University farm nursery located at 18°53'70.3" South and 32°36'27.9" East and at an altitude of 1131 meters from sea level. Stem cuttings were collected from the fever tea mother plants. The experiment was laid out in a completely randomized design with 5 replicates per treatment.

The treatments consisted of a rooting medium (sand), Seradix® No 2; 0.3% IBA and aloe vera gel. A total of 300 stem cuttings were prepared using sterile pruning scissors. These were cut to a length 20 cm and each treatment was replicated five (5) times. To reduce desiccation, the cuttings were wrapped with wet newspaper before planting.

The aloe vera leaves were detached from the mother plant and washed with water to remove any grime. The leaf was left for about ten minutes in a glass so that the yellow resin contained in them comes out. Both ends of the leaf were cut off and the skin was peeled off. Following (C6 Beauty's (2022) protocol, the pulp of the leaf was removed, crushed to get rid of any lumps and refined into the Aloe vera gel. The 100% Aloe vera gel was diluted to make the second and third treatments using 75% and 25% water. The bases of the 150 cuttings for the three treatments, were dipped in the aloe vera gel at different concentrations to a depth of 1 cm and were left for one hour to absorb the rooting agent. The number of cuttings that have formed shoots, the number of days taken to root, rooting percentage and the number of cuttings that were still alive after 5, 10, 15 and 20 days were recorded and analyzed according to a model for CRD;

YIJK = u + T i + E ijk
Where: Yijk is the response variable
μ is the overall mean
T i is the supplement effect
Eijk is a random error

Results

As indicated in Table 1, there was no significant difference (p>0.05) between Seradix treatment and 100% aloe vera gel. 100% aloe vera gel, 75% aloe vera gel and aloe vera plant treatment were not significantly different from each other. There was no significant difference between aloe vera plant, 25% aloe vera gel treatment and no treatment. The Seradix treatment was significantly different from the other four treatments.

Table 1: Effect of rooting treatment on shoot formation of fever tea cuttings

Treatment	Days from planting			
	5	10	15	20
Seradix No. 2	22.0a	68.0a	80.0a	86.0a
100% Aloe vera gel	14.0ab	48.0b	70.0a	74.0a
75% Aloe vera gel	8.0bc	22.0c	36.0b	42.0b
25% Aloe versa gel	2.0c	8.0d	16.0c	24.0bc
Aloe vera plant	10bc	20.0c	32.0b	38.0b
No treatment	0c	6.0d	8.0c	8.0c
Mean	9.3	28.7	40.3	45.3
$LSD_{0.05}$	11.32	12.95	17.42	20.12
Significance	0.007	< 0.001	< 0.001	< 0.001
CV%	920	34.2	32.7	33.6

LSD, Least significant difference; CV, Coefficient of Variation

Means in the same column with at least no common superscript differ significantly (p<0.001).

There was also no significant difference (p>0.05) between 25% aloe vera gel treatment and no treatment. 25% aloe vera gel and aloe vera plant were not significantly different from each other (Day 10, Table 1). 100% aloe vera gel was significantly different from the Seradix treatment. Both treatments were significantly different from the 75%, 25%, aloe vera plant and no treatment.

There was also no significant difference (p>0.05) between Seradix and 100% aloe vera plant treatment. However, both treatments were significantly different from the other three treatments (at day 15, Table 1). There was also no significant difference between 75% aloe vera gel and aloe vera plant treatments but both treatments were significantly different from the other three treatments. 25% aloe vera gel and no treatment were not significantly different from each other but significantly different from the rest of the four treatments.

There was no significant difference (p>0.05) between Seradix and 100% aloe vera gel treatment but significantly different from the other four treatments (Day 15, Table 4.1). 75% aloe vera gel and 25% aloe vera gel treatments were not significantly different from each other. 25% aloe vera gel and aloe vera plant treatments were not significantly different from each other. The 25% aloe vera gel and no treatment were not significantly different from each other.

As indicated in Figure 1, the influence of rooting treatment was significant (p<0.05) in influencing the shooting formation percentage of fever tea cuttings. The trend showed increased shooting as the days progressed. Results also showed that the highest number of cuttings that were able to shoot were registered from cuttings treated with Seradix No 2. However, these did not differ statistically (p>0.05) with cuttings treated with 100% aloe vera gel. Except for the commercial product (Seradix No 2), the least proportion of cuttings that formed shoots (8.00%) was recorded from the control treatment at 20 days after planting while the highest proportion (74.00%) was recorded from 100% aloe vera gel treated cuttings. The grand mean proportion for the budded cuttings for all treatments was 45.30%.

The Trend of effect of rooting treatment on root development on fever tea cuttings indicates that Seradix outperformed the rest of the treatments (Fig 2). However, the 75% treatment indicated fairly reasonable responses in rooting.

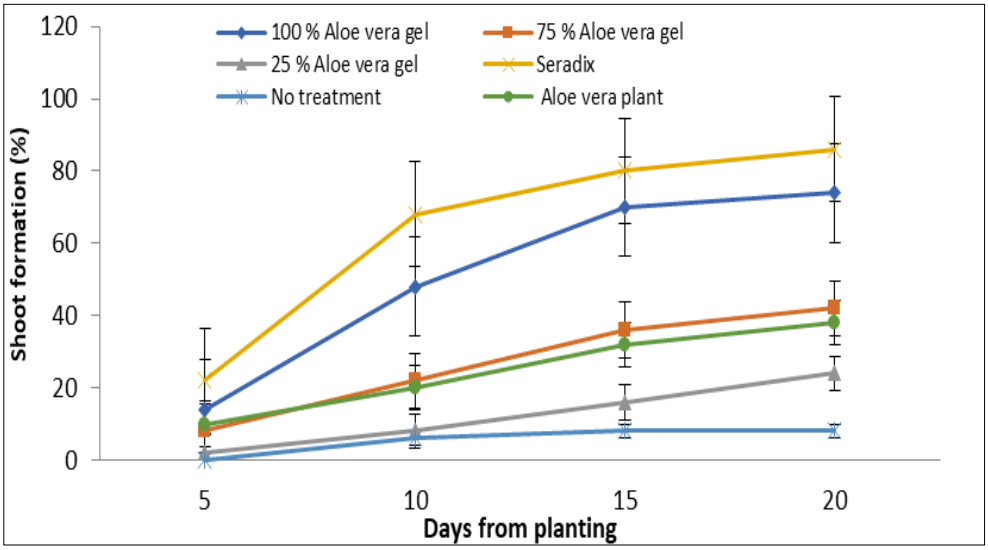

Fig 1: Effect of rooting treatment on shoot formation of fever tea cuttings

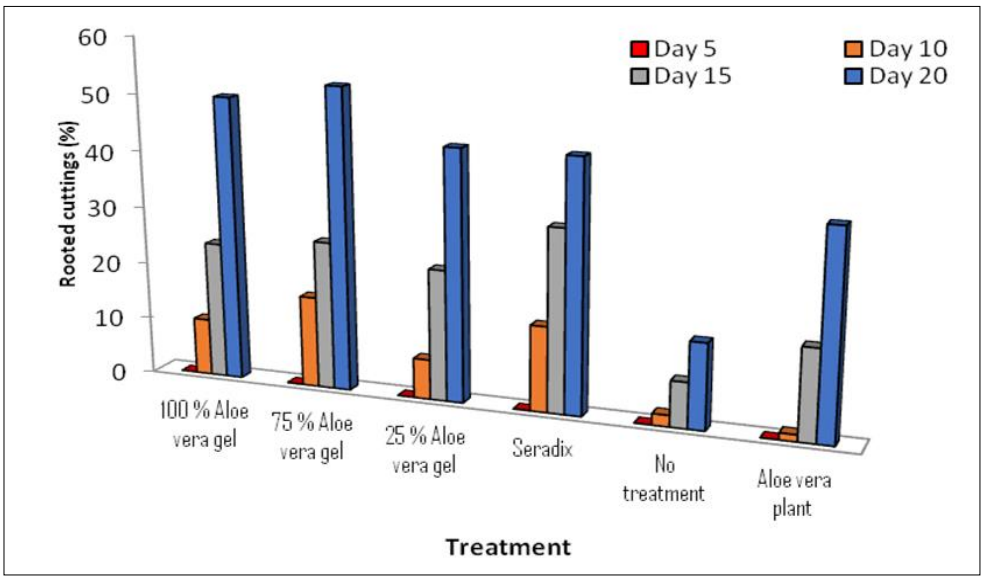

Fig 2: Effect of rooting treatment on root development on fever tea cuttings

As shown in Figure 3, there was no significant difference between no treatment and aloe vera plant treatments. However, the two are significantly different from the 100%, 75%, 25% aloe vera gel and Seradix treatment.

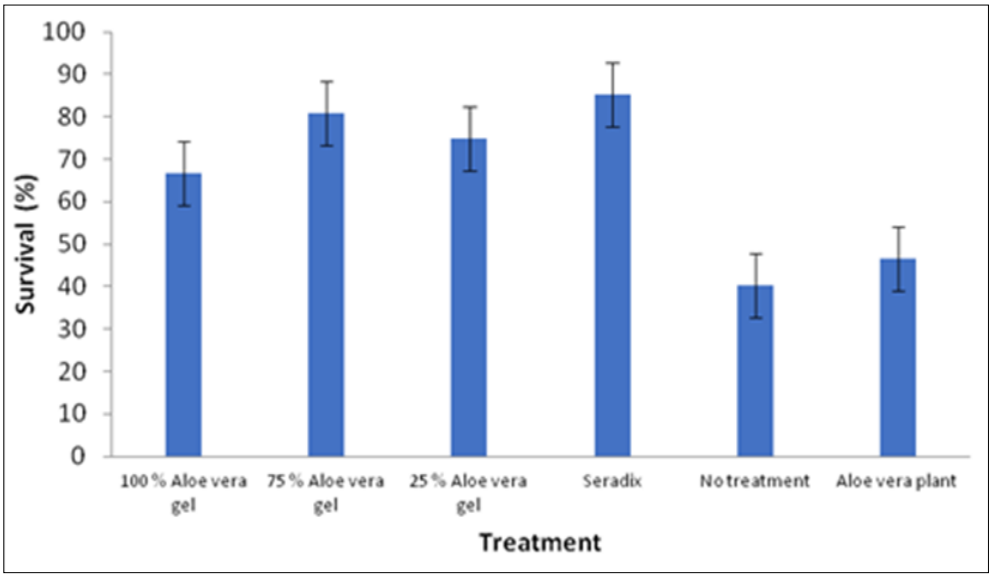

Fig 3: Effect of rooting treatment on survival of fever tea seedlings

Discussion

75% Aloe vera gel had the highest cumulative proportion of the rooted cuttings and it was above the Seradix treatment possibly because the Aloe vera gel has anti-septic properties, that do not allow any fungal growth, so whilst it was promoting rooting it managed to help the cuttings to withstand longer in the rooting medium because they were protected from any fungal growth or any soil-borne pathogens like Pythium. Fernando (2020) [1] when working with *Citrus aurantifolia* observed that the Aloe vera leaves produce more rooting hormones after being separated from the plant as it has anti-inflammatory actions. Cuttings treated with Seradix No 2, only promote root development but do not protect the cuttings against any fungal development. The 100% aloe vera gel and the aloe vera plant also had less cumulative rooting percentage than the 75% aloe vera gel possibly because of the concentrated nature of the ingredients in Aloe vera. The water content that is in the 75% aloe vera gel may have impacted other properties that help induce the rooting.

Cuttings treated with aloe vera gel were able to survive at almost the same rate as those treated with Seradix because the gel enabled the cuttings to survive under aseptic conditions at the same time being able to develop roots.

Conclusion and Recommendation

Seradix No 2, 100% and 75% concentrated aloe vera gel gave the highest shoot formation. However, 75% concentrated aloe vera leaf gel had the highest survival rate among the 4 treatments. The control, aloe vera plant, and 25% concentrated aloe vera gel had the lowest shoot formation percentage and low survival rate.

The use of the 75% concentrated aloe vera gel treatment is recommended as a rooting hormone as it promoted shoot formation. Farmers with no access to Seradix can therefore comfortably use the aloe vera gel as it is equally effective, easy to prepare and the cost is not exorbitant.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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