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Growth and Economics of Production of Rooted Black Pepper (*Piper nigrum* L.) Cuttings as Affected by Drenching Cattle Urine

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An experiment on survival and growth of rooted black pepper (*Piper nigrum* L.) cuttings as affected by drenching cattle urine was conducted at Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the year 2023-24. Eleven treatments and 3 replications in Randomized Block Design *viz.* T_1 Cattle urine 5 %, T_2 Cattle urine 7.5 %, T_3 Cattle urine 10 %, T_4 Cattle urine 12.5 %, T_5 Cattle urine 15 %, T_6 Cattle urine 17.5 %, T_7 Cattle urine 20 %, T_8 Cattle urine 22.5 %, T_9 Cattle urine 25 %, T_{10} Keradix powder and T_{11} Control with the aim to investigate effect of drenching cattle urine on growth and economics of production of rooted black pepper cuttings. The highest length of sprout (65.17 cm), number of leaves per cutting (14.32) and leaf area (78.16 cm^2) were recorded in treatment T_7 i.e. drenching cattle urine 20 %. The maximum survival percentage (90.33%), net profit (₹ 2515.00**)** and B: C ratio (1.87) found in treatment T_7.

Keywords: Cattle urine; black pepper; cuttings; economics.

1. INTRODUCTION

Black pepper is the most important commercial spice crop and popularly known as the **"King of spices"**. According to year 2021-2022, in India 2,88,270 ha area under cultivation of black pepper with 96,730 t and 0.34 t/ ha production and productivity respectively. Among all states, Karnataka is the leading producer of black pepper, produces 55,640 t followed by Kerala which produces 34,420 t black pepper. Maharashtra produces relatively less as compared to other states 440 t [1]. Black pepper is propagated through seeds, cuttings, layering and grafting but propagation by shoot cutting is most popular, economical and suitable method to produce true to type. Keradix powder is the root growth promoting hormone used in agriculture. Among different organic sources cattle urine is a unique product of dairy which have huge property such as manure, antimicrobial agent, disinfectant. It contains 95% water, 2.5% urea and remaining 2.5% contains mineral salts, hormones and enzymes. It also contains iron, calcium, phosphorus, carbonic acid, potash, nitrogen, ammonia, manganese, iron, sulphur, phosphates, potassium, urea, uric acid, amino acids, enzymes, cytokine and lactose. In organic farming, cattle urine is used for preparation of number of growth promoter and bio- pesticides which are effective in improving soil fertility and management of large number of pests and diseases in varied group. The biochemical contents of the plants increased with cattle urine application. Therefore, the use of cattle urine provides better alternative to synthetic chemicals which are expensive and pose potential danger to the farmers, marketers, consumers and environment. Application of cattle urine has been reported to have a favorable impact, for enhancing productivity of different crops. Nowadays, pepper industry faces many challenges regarding quality planting material and post planting mortality. To overcome this problem, it is essential to understand and standardize the ideal dose of cattle urine to enhance survival and growth of rooted black pepper cuttings. Repeated application of growth promotors is essential to enhance sprouting, survival and growth of rooted black pepper cuttings. Hence, different concentration of cattle urine applied to initiate rooting in black pepper cutting. For growing healthy plantation of black pepper quality planting material needed which is free from pest and diseases. To supply healthy plant material application of growth promoters is essential. Hence, the present study begins to derive the rapid growth of cuttings at nursery stage so that they will reach appropriate size, height, no. of leaves and leaf area of cutting plant at the time of planting in the field as well as at the time of marketing.

2. MATERIALS METHODOLOGY

The field trial was conducted at nursery No. 4, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the year 2023-24. It is located between 17º 45" North longitude and 73º 12" East longitude. The experiment was laid out in Randomized Block Design (RBD) with eleven treatments replicated thrice. T_1 Cattle urine 5%, T_2 Cattle urine 7.5 %, T_3 Cattle urine 10 %, T_4 Cattle urine 12.5 %, T_5 Cattle urine 15 %, T_6 Cattle urine 17.5 %, T_7 Cattle urine 20 %, T_8 Cattle urine 22.5 %, T_9 Cattle urine 25%, T_{10} Keradix powder and T_{11} Control. The cuttings (100 cuttings/treatment /replication) were planted in polybags (5"x 8") which filled with potting mixture soil and well decomposed Farmyard Manure (FYM) in 3:1 proportion and *Trichoderma viridae* was added @ 50 g/kg of FYM. Application of 50 ml solution

of each treatment were given for each cutting from treatment T_1 to T_9. Drenching of cattle urine were applied at monthly interval while first drenching was given at five days after planting of cuttings and subsequent drenching done at monthly interval up to 6 months. For treatment T_{10}, basal portion of cuttings was dipped in Keradix powder before planting and treated cuttings were planted in polybags. For control (T_{11}), the rooted cuttings were planted in polybags without treatment. The sprout length was measured from base of sprout to the apical tip of the sprout per treatment per replication by using measuring scale. The fully opened leaves per cutting were counted at 180 days after planting. The number of cuttings survived per treatment per replication were counted at 180 days after planting and recorded in percentage. Leaf area was computed using leaf area meter. The survival percentage was recorded by counting survived cuttings out of 100 cuttings in each treatment and each replication. The data were statistically analyzed by the method suggested by Panse and Sukhatme [2].

3. RESULTS AND DISCUSSION

The result showed significant increase in sprout length, number of leaves per cutting and leaf area of black pepper cuttings 180 days after planting (Table 1). The maximum sprout length found in cattle urine 20 % (T_7- 65.17 cm) and it was closely followed by cattle urine 25% (T_9- 63.27 cm). The lowest length of sprout (38.39 cm) recorded in treatment control (T_{11}). This might be due to nutrient content such as N, P, K, Ca, Na and others present in cattle urine which stimulates cell division, elongation and differentiation process [3].

Similar trends were observed by Garande [4] in black pepper and Santoso et al. [5] in chrysanthemum.

The average number of leaves per cuttings was 11.65. The highest number of leaves per cuttings was observed in cattle urine 20 % (T_7- 14.32) and it was at par with cattle urine 25 % (T_9- 13.88). The lowest number of leaves found in control (T_{11}- 8.84). The cattle urine contains nitrogen which is component of chlorophyll molecule which permits plant to capture sunlight energy by the process of photosynthesis. Number of leaves increases might be due to increasing nitrogen through cattle urine as it increases photosynthesis process and makes more food availability for plant [6].

The present findings were similar to the research findings recorded by Yadav [7] in black pepper (*Piper nigrum* L.). Juvekar [8] found comparable results working in chillies (*Capsicum annum* L.) and Venugopal et al. [9] in madhunashini (*Gymnema sylvestre* R. Br.).

Among all treatments, drenching cattle urine 20 % recorded maximum leaf area (T_7- 78.16 cm²) which was statistically at par with drenching cattle urine 25 % and 22.5% (T_9- 7$_6$.17 cm² and T_8- 74.69 cm²). Cattle urine contains auxin like IAA which is responsible expansion of meristematic cells which eventually increase in leaf tissue, this might be the reason for highest leaf area when treated with cattle urine 20% [6].

The similar findings were reported by Adsure [10] in black pepper (*Piper nigrum* L.) and Kumari et al. [11] in mulberry (*Morus alba* L.).

Drenching various concentrations of cattle urine showed significant effect on survival percentage of black pepper cuttings. Result from the present investigation revealed that the highest survival was observed in treatment cattle urine 20 % (T_7- 90.33 %) which was statistically at par with treatment cattle urine 22.5 % (T_8- 89.33 %). The lowest survival percentage (66.33 %) was recorded in T_{11}, which was significantly lower than all the other treatments. Cattle urine contains nutrients and auxins which could have enhanced the development of an effective root system as well as vegetative growth. Cattle urine acts as bio fertilizer and bio pesticide which decreases mortality of the plants at early stage of planting [12]. The overall performance in relation to growth parameters of root and shoot were significantly better in treatment T_7 i.e. drenching cattle urine 20 % which ultimately increased survival percentage.

The results are in accordance with the research findings recorded by Jalgaonkar [6] in black pepper, Dorigol and Rajashekhargouda [13] in mulberry (*Morus alba* L.) and Smitha and Umesha [14] in stevia (*Stevia rebaudiana* (Bertoni) Hemsl) cuttings.

Table 2 shows the benefit cost ratio (B:C) for black pepper plants raised in nursery. Net profit was calculated on the basis of expenditure incurred and income received from the total number of black pepper plants that survived and sold at the end of the experiment. The highest net profit (₹ 2515.00) was recorded in treatment T_7 cattle urine 20% and the lowest net profit (₹1255.00) was noticed in treatment T_{11} i.e.

Control. While the maximum B:C ratio was recorded in treatment T_7 i.e. cattle urine 20% (1.87) this might be due to highest survival percentage and gross return and it was statistically at par with treatment T_8 i.e. cattle urine 22.5% (1.83).

Table 1. Effect of drenching cattle urine on sprout length, number of leaves per cutting and leaf area of black pepper cuttings at 180 days after planting

Treatments	Sprout length (cm)	Number of leaves per cutting	Leaf area (cm^2)
T_1- Cattle urine 5%	53.50	12.21	66.30
T_2- Cattle urine 7.5%	47.46	11.26	72.67
T_3- Cattle urine 10%	55.95	12.84	63.18
T_4- Cattle urine 12.5%	43.14	10.04	58.15
T_5- Cattle urine 15%	50.36	11.01	60.97
T_6- Cattle urine 17.5%	45.25	10.54	70.08
T_7- Cattle urine 20%	65.17	14.32	78.16
T_8- Cattle urine 22.5%	57.75	13.36	74.69
T_9- Cattle urine 25%	63.27	13.88	76.17
T_{10}- Keradix Powder	41.67	9.82	56.90
T_{11}- Control	38.89	8.84	53.29
Mean	**51.13**	**11.65**	**66.41**
Range	**38.89-65.17**	**8.84-14.32**	**53.29-78.16**
S. Em. ±	**1.009**	**0.246**	**1.191**
CD at 5 %	**2.978**	**0.727**	**3.512**
Result	**SIG**	**SIG**	**SIG**

Table 2. Effect of drenching black pepper cuttings with different concentrations of cattle urine on economics of production

Treatments	Survival (%)	Net Profit (₹)	B:C Ratio
T_1- Cattle urine 5 %	82.33 (65.31) *	2170.00	1.78
T_2- Cattle urine 7.5 %	79.33 (63.08)	1967.50	1.70
T_3- Cattle urine 10 %	85.00 (67.38)	2285.00	1.81
T_4- Cattle urine 12.5 %	75.67 (60.53)	1702.50	1.60
T_5- Cattle urine 15 %	81.33 (64.55)	2020.00	1.71
T_6- Cattle urine 17.5 %	78.33 (62.37)	1817.50	1.63
T_7- Cattle urine 20 %	90.33 (72.06)	2515.00	1.87
T_8- Cattle urine 22.5 %	89.33 (71.09)	2430.00	1.83
T_9- Cattle urine 25 %	88.00 (69.88)	2330.00	1.79
T_{10}- Keradix Powder	70.00 (56.84)	1459.00	1.53
T_{11}- Control	66.33 (54.56)	1255.00	1.46
Mean	**80.64**	**-**	**1.70**
S. Em. ±	**0.413**	**-**	**0.015**
CD at 5 %	**1.219**	**-**	**0.044**
Result	**SIG**	**-**	**SIG**

**Figures in parenthesis are arcsine transformed values*

Similar outcomes were reported by Jalgaonkar [6] in black pepper (cattle urine 20 %) and Pawar [15] in bush pepper (cattle urine10 %).

4. CONCLUSION

Among different treatments, drenching cattle urine 20 % (T_7) at monthly interval was recorded the maximum length of sprout, number of leaves per cutting, leaf area and survival percentage. Thus, on the basis of results revealed from above investigation, it can be concluded that treatment T_7 (cattle urine 20 %) gave excellent results for better growth performance of cuttings in black pepper and was also economically viable over rest of treatments in this study.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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