



# Evaluation of growth and yield of lemongrass varieties under arecanut-based agroforestry system in the Konkan region

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**ABSTRACT:** Lemongrass (*Cymbopogon flexuosus* L.) is an aromatic grass belonging to family Poaceae. The present investigation carried out to evaluation of growth and yield of lemon grass varieties under Aracanut based plantation in Konkan region of Maharashtra during year 2019-20 to 2021-22. The experiment consisted of 5 x 5 m of Ten year old Arecanut block plantation with combination of Six varieties of the lemon grass  $V_1$  (Chirharita),  $V_2$  (Nima),  $V_3$  (CKP-25),  $V_4$  (Krishna),  $V_5$  (Praman) and  $V_6$  (Kaveri). From the present investigation it can be result revealed that with respect to morphological growth and herbage yield parameter statically significant at 5% level. The growth and yield parameters such as Plant height, Number of leaves, Number of tillers, essential oil content and herbage yield per plant and per hectare,  $T_1$  (Krishna) variety of lemongrass shows better results when compared to other varieties A significant variation in areca nut yield (t/ha) was observed among the six lemon grass varieties intercropped with Arecanut during the years 2019–20, 2021–22 and 2022–23 as well as in the pooled data. The results clearly demonstrate that the Krishna ( $V_4$ ) variety had a pronounced positive influence on areca nut productivity in the intercropping system. Its superior performance across all years indicates a favorable growth compatibility and resource-use efficiency in the arecanut-based agroforestry system.

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## 1. INTRODUCTION

Aromatic grasses represent a significant portion of the natural plant resources found in tropical and subtropical regions such as India. However, not all of these species are commercially exploited and many remain uncultivated. With the growing understanding of their chemistry, utility and productivity, several aromatic grasses have gained prominence in the essential oil and perfumery industries (Gawali, 2025). As a result, many of these species have now been domesticated and brought under systematic cultivation following genetic improvement programs aimed at enhancing oil content and quality (Gawali and Meshram, 2019). Lemongrass is one of the most economically important aromatic grasses belonging to the family Poaceae. The major cultivated species include East Indian lemongrass (*Cymbopogon flexuosus*), West Indian lemongrass (*Cymbopogon pendulus*), and *Cymbopogon citratus*. Among these, East Indian lemongrass is particularly significant; it is a perennial, multi-cut crop that can be propagated both

vegetative and through seeds, thriving well in tropical and subtropical regions. The name “lemongrass” is derived from its characteristic lemon-like aroma, which is released when the leaves are crushed. This distinctive fragrance is primarily attributed to the presence of citral (a mixture of  $\alpha$ - and  $\beta$  isomers), an acyclic monoterpene aldehyde. Lemongrass oil is widely used in perfumery, soaps and cosmetics for its pleasant lemon note. Moreover, citral extracted from the oil serves as an important raw material in the perfumery, confectionery, and beverage industries and as a key precursor for the synthesis of  $\beta$ -ionone, which is further used in the production of Vitamin A and several other valuable chemicals.

In India, lemongrass is extensively cultivated across several states, including Maharashtra, Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, West Bengal, Uttar Pradesh, and Jammu & Kashmir. Over the last two decades, several high-yielding varieties have been developed through studies on morphological and physiological traits. Notable varieties include CKP-25, Praman, Cauvery, Krishna, Pragati, Nima, and Chirharit. The hot and humid agroclimatic conditions of the Konkan region are particularly favorable for lemongrass cultivation. Evaluating the performance of different varieties under these conditions helps identify the most suitable types that can adapt and perform best in the region’s specific agroclimatic environment. In recent years, greater emphases has

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been placed on promoting native, fast-growing, and multipurpose crops in plantation systems rather than relying on exotic species, as native species contribute to biodiversity conservation and enhance long-term site productivity. Arecanut (*Areca catechu* L.), commonly known as betel nut, is a high-value commercial crop of India and is widely cultivated in countries such as the Philippines, Indonesia, Sri Lanka, southern China, Taiwan, and Java. India ranks first globally in arecanut production and the crop is widely promoted under agroforestry systems in the humid and sub-humid tropics for nut production. Despite its economic importance, limited studies have been conducted to assess the growth and yield performance of lemongrass under monocropping systems, and very little information is available regarding its performance in agroforestry (agrisilvicultural) systems. Therefore, the present study was undertaken to evaluate the growth and yield performance of lemongrass under an agrisilviculture system involving arecanut, with the objective of identifying suitable combinations for enhanced productivity and resource utilization.

## 2. MATERIALS AND METHODS

### Study site

The experiment was conducted during 2018–19 to 2021–22 at the research farm of the All India Coordinated Research Project (AICRP) on Agroforestry, College of Forestry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The site is located on the west coast of Maharashtra, India, at 17.7266° N latitude and 73.2949° E longitude, with an elevation of 280 meters above mean sea level, approximately 25 km inland from the Arabian Sea. The present research was conducted in a 10-year-old arecanut (*Areca catechu* L.) block plantation with a spacing of 5 × 5 m, to evaluate the performance of six lemongrass varieties—V<sub>1</sub>: Chirharita, V<sub>2</sub>: Nima, V<sub>3</sub>: CKP-25, V<sub>4</sub>: Krishna, V<sub>5</sub>: Praman, and V<sub>6</sub>: Kaveri. The experiment was laid out in a Completely Randomized Block Design (CRBD) with four replications. Healthy, well-rooted slips of lemongrass were transplanted at a spacing of 60 × 60 cm on raised ridges and furrows, each experimental plot measuring 5 × 5 m. During land preparation, farmyard manure was applied as a basal dose at the rate of 10–15 t/ha and thoroughly incorporated into the soil. A basal application of NPK fertilizer was given at the rate of 120:60:40 kg/ha, with the remaining nitrogen applied three months after planting. Morphological parameters such as plant height, number of tillers and leaf length were recorded 120 days after planting (DAP) using standard procedures. The herbage yield, essential oil content, and oil yield per hectare were recorded after each harvest 120 days after planting.

### Essential oil extraction

The essential oil from the leaves of lemon grass clones was extracted via hydrodistillation via a closed type Clevenger apparatus for the extraction of oils lighter than water. One hundred grams of 4-5 hour shade-dried leaves were cut into small pieces and placed into 2000 ml round glass flasks along with distilled water. The content of the flask was heated to boiling. Heating was continued for 4 hours, and the mixture was allowed to stand for 1 hr. The stopper of the Clevenger apparatus was opened. The water was drawn out slowly until the surface of the oil layer corresponded to the preparation line and was allowed to stand for some time. The surface of the layer was lowered to the zero line, and the volume of the oil was measured under the same conditions. The process was repeated in triplicate. The leaf essential oil yield per plant was expressed as a percentage per clone and was determined via the following formula:

$$\text{Leaf essential oil content (\%)} = \frac{\text{Essential oil extracted (ml)}}{\text{Weight of dried leaves used for extracting (g)}}$$

### Statistical analysis

The data collected for all morphological and essential oil parameter in the study underwent were analyzed using the standard statistical procedure of Randomized Block Design (Panse and Sukhatame, 1985). The results of these analyses are presented in tables and complemented with appropriate graphical representations, which are included in the results.

## 3. RESULTS AND DISCUSSION

### Plant height

The result on plant height is presented in Table 1. A significant variation in plant height was observed among the six varieties of lemongrass across the three years (2019–20, 2021–22, and 2022–23) as well as in the pooled mean data. During 2019–20, plant height ranged from 85.05 cm V<sub>2</sub>( Nima) to 149.13 cm V<sub>4</sub> ( Krishna), with a mean height of 119.80 cm. A similar trend was recorded in 2021–22, where Krishna (V<sub>4</sub>) exhibited the maximum height (149.50 cm) and Nima (V<sub>2</sub>) the minimum (80.78 cm), with an overall mean of 122.13 cm. In 2022–23, plant height varied between 85.31 cm (V<sub>2</sub>) and 151.84 cm (V<sub>4</sub>), with a mean of 123.53 cm. Considering the pooled mean over three years, the plant height ranged from 83.71 cm in V<sub>2</sub> (Nima) to 150.16 cm in V<sub>4</sub> (Krishna). The highest pooled plant height was recorded in Krishna (150.16 cm), followed by Kaveri (143.50 cm) and CKP-25 (126.10 cm), whereas the lowest was in Nima (83.71 cm). The overall pooled mean height was 121.82 cm. The statistical analysis revealed significant differences among varieties at the 5% level. The results indicate that genetic variability exists among

the studied lemongrass varieties with respect to plant height. The consistent superiority of Krishna (V<sub>4</sub>) across all years suggests it possesses a strong genetic potential for vigorous growth under the Arecanut based plantation. In contrast, Nima (V<sub>2</sub>) consistently recorded the lowest plant height, reflecting a dwarf or slow-growing habit. Therefore, Krishna (V<sub>4</sub>) can be regarded as the most promising variety for traits associated with plant vigor and biomass accumulation, whereas Nima (V<sub>2</sub>) may be preferred in conditions where a smaller plant stature is desirable. Our findings align with Lal *et al.* (2006), who evaluated the plant height of several lemongrass clones and reported that four elite clones exhibited heights ranging from 100 to 160 cm. Similarly, Yogendra *et al.* (2022) observed that lemongrass plants typically attain heights between 108.47 and 136.75 cm, supporting the range of variability noted in the present study. Raj *et al.* (2010) reported that the plant height of lemon grass 1.65 m and 1.86 m was observed in applied fertilizer dose (150 N: 60P: 60 K Kg/ha) with spacing 30cm x 45 cm x 45 cm in shade of Poplar tree and open condition.

### Number of Leaves

The observation of the number of leaves per plant was presented in Table 2. All six lemongrass varieties showed significant variation across the three years (2019–20, 2021–22, and 2022–23). The pooled data indicated that the variety Krishna (V<sub>4</sub>) recorded the maximum mean number of leaves (155.00), followed by Kaveri (V<sub>6</sub>) with 139.58 leaves and Praman (V<sub>5</sub>) with 132.42 leaves per plant. The variety CKP-25 (V<sub>3</sub>) produced a moderate number of leaves (124.58), whereas Chirharita (V<sub>1</sub>) and Nima (V<sub>2</sub>) recorded comparatively lower leaf counts (105.25 and 109.00, respectively). Across the years, the overall mean number of leaves per plant increased from 123.93 in 2019–20 to 138.35 in 2022–23, indicating a consistent improvement in plant growth performance over time. The observed differences among varieties indicate that genetic variability plays a major role in determining the number of leaves per plant in lemongrass. The superior performance of Krishna (V<sub>4</sub>) suggests its enhanced vegetative vigor and greater photosynthetic potential, which may directly

**Table 1 Plant height (cm) of different lemon grass varieties**

Varieties	Plant height (cm)			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	106.30	110.41	113.84	110.18
V <sub>2</sub> (Nima)	85.05	80.78	85.31	83.71
V <sub>3</sub> (CKP-25)	127.13	126.38	124.81	126.10
V <sub>4</sub> (Krishna)	149.13	149.50	151.84	150.16
V <sub>5</sub> (Praman)	109.04	122.31	120.44	117.26
V <sub>6</sub> (Kaveri)	142.18	143.38	144.94	143.50
Mean	119.80	122.13	123.53	121.82
SE	0.42	0.81	6.21	0.05
CD at 5%	1.26	2.45	18.71	0.15
CV %	0.7	1.34	10.05	0.08

**Table 2 Number of leaves of different lemon grass varieties**

Varieties	Number of leaves per plant			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	102.75	105.30	107.80	105.25
V <sub>2</sub> (Nima)	96.75	106.50	123.76	109.00
V <sub>3</sub> (CKP-25)	122.88	124.87	126.00	124.58
V <sub>4</sub> (Krishna)	154.82	156.80	155.50	155.00
V <sub>5</sub> (Praman)	126.75	128.35	124.25	132.42
V <sub>6</sub> (Kaveri)	139.45	140.35	138.30	139.58
Mean	123.93	126.72	138.35	128.46
SE	1.35	1.86	2.2	0.33
CD at 5%	3.9	5.35	6.51	0.96
CV %	2.19	2.94	3.42	0.37

contribute to higher biomass and essential oil yield. The consistently high leaf count in Kaveri (V<sub>6</sub>) and Praman (V<sub>5</sub>) also reflects their suitability for high-yield foliage production systems. The increasing trend in the number of leaves across the years may be attributed to improved plant maturity, adaptation to local agro-climatic conditions, and cumulative effects of crop management practices. Overall, Krishna (V<sub>4</sub>) emerged as the most promising variety for higher leaf production in lemongrass, followed by Kaveri (V<sub>6</sub>) and Praman (V<sub>5</sub>), while Chirharita (V<sub>1</sub>) and Nima (V<sub>2</sub>) showed relatively lower vegetative growth potential. According to Mallikarjun *et al.* (2021) the number of leaves of citronella varies according to the environmental conditions. Similar variations also have been reported by Patra *et al.* (1989) and Yadava (2001).

#### Number of Tillers

The observation of the number of tillers per plant was presented in Table 3. A significant variation in the number of tillers per plant was recorded among the six lemongrass varieties across all three years (2019–20,

2021–22, and 2022–23) as well as in the pooled data. During 2019–20, the number of tillers per plant ranged from 22.89 V<sub>5</sub> (Praman) to 46.60 V<sub>4</sub> (Krishna), with an overall mean of 32.05. In 2021–22, the values ranged between 24.83 (V<sub>5</sub>) and 47.88 (V<sub>4</sub>), with a mean of 33.91. Similarly, in 2022–23, Krishna (V<sub>4</sub>) again produced the maximum number of tillers (48.38), whereas Praman (V<sub>5</sub>) recorded the lowest (25.28), with a mean of 34.75 tillers per plant. On the basis of pooled data, the number of tillers per plant varied from 24.29 (V<sub>5</sub> Praman) to 47.62 (V<sub>4</sub> Krishna), with a pooled mean of 33.53. The varieties Krishna (V<sub>4</sub>) and CKP-25 (V<sub>3</sub>) recorded higher tillering (47.62 and 36.59, respectively), while Praman (V<sub>5</sub>) consistently recorded the lowest number of tillers (24.29). The differences among varieties were statistically significant at the 5% level (CD = 0.15). The results show that there was substantial genetic variability among lemongrass varieties for the trait of tiller production. The consistent superiority of Krishna (V<sub>4</sub>) across all experimental years suggests that this variety possesses a high tillering potential, contributing to its overall vigor and likely higher biomass productivity.

**Table 3** Number of tillers per plant of different lemon grass varieties

Varieties	Number of tillers /plant			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	30.06	32.35	33.48	31.72
V <sub>2</sub> (Nima)	27.68	30.05	30.95	29.56
V <sub>3</sub> (CKP-25)	35.50	36.43	37.85	36.59
V <sub>4</sub> (Krishna)	46.60	47.88	48.38	47.62
V <sub>5</sub> (Praman)	22.89	24.83	25.28	24.29
V <sub>6</sub> (Kaveri)	29.63	31.98	32.60	31.41
Mean	32.05	33.91	34.75	33.53
SE	0.17	0.36	0.15	0.05
CD at 5%	0.51	1.09	0.47	0.15
CV %	1.07	2.14	0.9	0.31

**Table 4** Essential oil content in foliage of different lemon grass varieties

Varieties	Essential oil content in foliage (%)			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	0.65	0.63	0.65	0.64
V <sub>2</sub> (Nima)	0.55	0.55	0.58	0.56
V <sub>3</sub> (CKP-25)	0.78	0.75	0.78	0.77
V <sub>4</sub> (Krishna)	1.05	1.08	1.18	1.10
V <sub>5</sub> (Praman)	0.55	0.58	0.59	0.57
V <sub>6</sub> (Kaveri)	0.63	0.65	0.74	0.67
Mean	0.70	0.704	0.750	0.72
SE	0.05	0.04	0.05	0.01
CD at 5%	0.17	0.14	0.16	0.04
CV %	16.56	13.62	14.42	3.7

The CKP-25 (V<sub>3</sub>) variety also maintained moderately high tiller numbers, indicating its adaptability under the given agro-climatic conditions. In contrast, Praman (V<sub>5</sub>) exhibited the lowest tiller count throughout the years, suggesting either a genetic tendency toward fewer shoots or lower adaptability to the experimental environment. The low CV values in all years confirm that the observed differences among varieties are genetically determined rather than due to environmental variability. Therefore, the variety Krishna (V<sub>4</sub>) can be considered the most promising for enhanced vegetative growth and productivity potential in lemongrass.

Our results are consistent with the findings of Yogendra *et al.* (2022), who reported that the number of tillers per citronella plant ranged from 38.13 to 47.60. In their study, the highest mean number of tillers per clump was observed in Mandakini (96.77), followed by Manjusha (80.87), while the lowest was recorded in CIM Jeeva (50.30). The variation in tiller number among genotypes was attributed to differences in genetic makeup and environmental influences, which aligns with earlier observations by

Singh and Singh (1999) in lemongrass, as well as Lynrah and Chakrabarthy (2000) and Sharma *et al.* (2002) in *Cymbopogon pendulus*. Furthermore, Sharma *et al.* (2002) noted that the optimum number of tillers per plant in lemongrass is generally achieved during the flowering stage. Similarly, Lal *et al.* (2006) reported that among four elite lemongrass clones, the number of tillers per plant ranged from 45 to 65, supporting the range of variability observed in the present study. Raj *et al.* (2010) reported that the number of tiller of lemon grass 70 and 80 was observed in applied fertilizer dose (150 N: 60P: 60 K Kg/ha) with spacing 30cm x 45 cm in shade of Poplar tree and open condition. Similar variations also have been reported by Patra *et al.* (1989) and Yadava (2001).

#### Essential oil content

The essential oil content in the foliage of six lemongrass varieties showed significant variation across the three years (2019–20, 2021–22, and 2022–23) presented in Table 4. The pooled data revealed that the variety Krishna (V<sub>4</sub>) recorded the highest mean oil content (1.10%), followed by CKP-25 (0.77%), while the lowest was observed in Nima

**Table 5** Herbage yield per plant of different lemon grass varieties

Varieties	Herbage yield /Plant (kg)			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	0.354	0.405	0.416	0.392
V <sub>2</sub> (Nima)	0.228	0.345	0.353	0.309
V <sub>3</sub> (CKP-25)	0.329	0.425	0.428	0.394
V <sub>4</sub> (Krishna)	0.414	0.564	0.589	0.522
V <sub>5</sub> (Praman)	0.281	0.348	0.365	0.331
V <sub>6</sub> (Kaveri)	0.371	0.318	0.430	0.373
Mean	0.330	0.401	0.430	0.387
SE	0.01	0.04	0.06	0.014
CD at 5%	0.04	0.12	0.10	0.043
CV %	10.03	20.18	16.72	7.32

**Table 6** Herbage yield (t/ha) of different lemon grass varieties

Varieties	Herbage yield (t/ha)			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	18.87	19.12	19.62	19.20
V <sub>2</sub> (Nima)	12.14	13.13	13.88	13.04
V <sub>3</sub> (CKP-25)	17.52	18.02	18.75	18.09
V <sub>4</sub> (Krishna)	22.20	23.20	24.20	23.20
V <sub>5</sub> (Praman)	15.37	15.87	16.25	15.83
V <sub>6</sub> (Kaveri)	19.61	20.11	20.61	20.10
Mean	17.62	18.24	18.88	19.20
SE	0.24	0.22	2.27	0.14
CD at 5%	0.73	0.68	0.81	0.46
CV %	2.78	2.5	2.86	1.4

(0.56%) and Praman (0.57%). The variety Chirharita and Kaveri showed moderate oil content with pooled means of 0.64% and 0.67%, respectively. Across the years, the overall mean oil content increased slightly from 0.70% in 2019–20 to 0.75% in 2022–23, indicating a gradual improvement over time. The results indicate that genotypic differences significantly influenced the essential oil concentration among the six lemongrass varieties. The Krishna (V<sub>4</sub>) variety consistently outperformed others across all years, suggesting its superior potential for essential oil yield. The CKP-25 (V<sub>3</sub>) also showed relatively high and stable oil content, making it another promising variety. The moderate performance of Chirharita and Kaveri, along with the lower values for Nima and Praman, suggests varietal diversity that could be exploited for selection and improvement. Overall, the findings highlight Krishna as the most suitable variety for higher essential oil production intercropped with arcanut, while CKP-25 could be considered a stable performer with consistent yield potential over the years.

#### Herbage yield per plant

A considerable variation in herbage yield per plant was observed among the six lemongrass varieties during the three years (2019–20, 2021–22 and 2022–23) as well as in the pooled mean data was presented Table 5. In 2019–20, herbage yield per plant ranged from 0.228 kg V<sub>2</sub> (Nima) to 0.414 kg V<sub>4</sub> (Krishna), with a mean of 0.330 kg. During 2021–22, the yield ranged from 0.318 kg V<sub>6</sub> (Kaveri) to 0.564 kg V<sub>4</sub> (Krishna) and the overall mean increased to 0.401 kg. In 2022–23, the yield again ranged between 0.353 kg V<sub>2</sub> (Nima) and 0.589 kg V<sub>4</sub> (Krishna), with a higher mean of 0.430 kg. On the basis of pooled data, the herbage yield per plant varied from 0.309 kg V<sub>2</sub> (Nima) to 0.522 kg V<sub>4</sub> (Krishna), with an overall pooled mean of 0.387 kg. The highest herbage yield was consistently obtained in Krishna (V<sub>4</sub>), followed by CKP-25 V<sub>3</sub> (0.394 kg) and

Chirharita V<sub>1</sub> (0.392 kg). The lowest yield was recorded in Nima (V<sub>2</sub>). The results clearly reveal genetic variability in biomass production potential among the evaluated lemongrass varieties. The consistently superior performance of Krishna (V<sub>4</sub>) across all years indicates its high genetic potential for herbage yield, which may be attributed to its greater plant height and higher tiller number, as observed in the corresponding morphological parameters. This suggests that vigorous vegetative growth traits are positively associated with biomass accumulation in lemon grass. Varieties such as CKP-25 (V<sub>3</sub>) and Chirharita (V<sub>1</sub>) also performed moderately well, indicating their adaptability under the experimental agro-climatic conditions. In contrast, Nima (V<sub>2</sub>) exhibited the lowest yield throughout the study, suggesting either lower growth vigor or less efficient resource utilization. Overall, the variety Krishna (V<sub>4</sub>) can be identified as the most promising genotype for herbage yield improvement and potential large-scale cultivation in lemongrass intercropped with arcanut based plantation.

#### Herbage yield

Significant variations in herbage yield per hectare were recorded among the different lemongrass varieties during all three years of experimentation (2019–20 to 2022–23) was presented in Table 5. The differences among varieties were found to be statistically significant at the 5% level. The pooled data revealed that the variety Krishna (V<sub>4</sub>) produced the highest herbage yield (23.20 t/ha), followed by Kaveri (V<sub>6</sub>) with 20.10 t/ha and Chirharita (V<sub>1</sub>) with 19.20 t/ha. The lowest yield was recorded in Nima (V<sub>2</sub>) with 13.04 t/ha. Across the three years, a consistent increasing trend in herbage yield was observed for all varieties, indicating the influence of plant maturity and favorable environmental conditions during successive harvests. The overall mean herbage yield increased from 17.62 t/ha in 2019–20 to 18.88 t/ha in

**Table 7 yield of Arcanut intercropped with lemon grass**

Varieties	Nut yield (t/ha)			
	2019-20	2021-22	2022-23	Pooled
V <sub>1</sub> (Chirharita)	2.70	2.98	3.00	2.92
V <sub>2</sub> (Nima)	2.57	2.80	2.90	2.79
V <sub>3</sub> (CKP-25)	2.72	2.93	3.03	2.92
V <sub>4</sub> (Krishna)	3.38	3.65	3.73	3.62
V <sub>5</sub> (Praman)	2.83	3.00	3.08	2.99
V <sub>6</sub> (Kaveri)	2.93	3.05	3.15	3.07
Mean	2.85	3.07	3.15	3.05
SE	0.12	0.15	0.13	0.014
CD at 5%	0.37	0.45	0.41	0.043
CV %	8.81	9.82	8.74	0.94

2022–23, with a pooled mean of 19.20 t/ha. The superior performance of variety Krishna may be attributed to its vigorous growth habit, higher tillering ability and better adaptability under the prevailing agro-climatic conditions. Similar findings have been reported by Yogendra *et al.* (2022) and Singh *et al.* (2020), who observed higher herbage yields in Krishna due to its genetic potential for enhanced biomass accumulation.

#### Yield of Arecanut

A significant variation in areca nut yield (t/ha) was observed among the six lemon grass varieties intercropped with Arecanut during the years 2019–20, 2021–22 and 2022–23 as well as in the pooled data was presented in Table 6. The differences among varieties were statistically significant at the 5% level. In 2019–20, areca nut yield ranged from 2.57 t/ha to 3.38 t/ha with a mean of 2.85 t/ha. During 2021–22, the yield increased across all varieties, intercropped ranging from 2.80 t/ha to 3.65 t/ha with a mean of 3.07 t/ha. Similarly, in 2022–23, yield values varied between 2.90 t/ha and 3.73 t/ha with a higher mean of 3.15 t/ha. Based on pooled mean data, the areca nut yield ranged from 2.79 t/ha to 3.62 t/ha with an overall mean of 3.05 t/ha. Among the varieties, Krishna (V<sub>4</sub>) intercropped with arecanut consistently produced the highest yield (3.62 t/ha), followed by Kaveri (V<sub>6</sub>: 3.07 t/ha) and Praman (V<sub>5</sub>: 2.99 t/ha), while Nima (V<sub>2</sub>) recorded the lowest yield (2.79 t/ha). The results clearly demonstrate that the Krishna (V<sub>4</sub>) variety had a pronounced positive influence on areca nut productivity in the intercropping system. Its superior performance across all years indicates a favorable growth compatibility and resource-use efficiency in the arecanut-based agroforestry setup. The consistent increase in yield from 2019–20 to 2022–23 also suggests that system productivity improved with crop maturity and better canopy establishment. Moderate yields recorded by Kaveri (V<sub>6</sub>) and Praman (V<sub>5</sub>) indicate that these varieties are also well-suited for association with arecanut, though to a lesser extent compared to Krishna. Conversely, Nima (V<sub>2</sub>) consistently recorded the lowest arecanut yield, which may be attributed to less vigorous growth or competitive interference affecting nutrient availability and light interception within the system. Overall, the findings suggest that the Krishna (V<sub>4</sub>) variety enhances the productivity and compatibility of arecanut-based agroforestry systems and can be recommended for maximizing yield performance intercropped with Arecanut.

#### 4. CONCLUSION

From the present investigation it can be concluded that

with respect to growth characteristics such as Plant height, Number of leaves, Number of tillers, essential oil content and herbage yield per plant and per hectare Treatment T<sub>4</sub> (Krishna) variety of lemongrass shows better results when compared to other varieties. The results clearly demonstrate that the Krishna (V<sub>4</sub>) variety had a pronounced positive influence on areca nut productivity in the intercropping system. Its superior performance across all years indicates a favorable growth compatibility and resource-use efficiency in the arecanut-based cropping system. The consistent increase in yield of lemon grass and arecanut suggests that system productivity improved with crop yield.

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