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SCREENING OF PALMAROSA, *CYMBOPOGON MARTINII* VAR. *MOTIA* UNDER SALT AFFECTED SOILS

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ABSTRACT

The present study was conducted at Horticultural College and Research Institute for women, Tiruchirappalli to screen palmarosa accessions under salt affected soil. Palmarosa seeds *viz*., Trishna, Tripta, CIMAP Harsh, Vaishnavi, PRC-1, Haryana No. 49 and local types were collected and sown in beds. Seeds started germinating in 4-5 days. The seedlings of 35 days old were transplanted on ridges at spacing of 60 x 45 cm. There was a significant difference recorded on plant height, establishment, plant height, number of tillers/plants, root length, foliage yield and oil yield. It was observed that the establishment was significantly better in CMM 5 (82.10%) followed by CMM 3 (80.60%) whereas the establishment was low in Coimbatore local. The number of tillers was significantly higher in CMM 4 (39.33) and CMM 1 (39.00). The smaller number of tillers were recorded in CMM 2 (33.00) and CMM 6 (34.33). The plant height was significantly higher in CMM 3 (146.00 cm) and CMM 4 (145.00 cm) followed by CMM 5 (140.33 cm). The plant height was less in CMM 1 (90.67 cm). The yield/plot was recorded significantly higher in CMM 3 (7.10 kg) followed by CMM 5 (6.90 kg). The essential oil was significantly higher in CMM 5 (0.054 kg/plot/harvest; 108.5 kg/acre/year) followed by CMM 3 (0.047 kg/plot/harvest; 93.6 kg/acre/year). Similarly, geraniol content was significantly higher in CMM 5 (81.2%) followed by CMM 3 (79.1%). There is a great scope for cultivation of palmarosa profitably in salt affected soils.

Keywords **:** Palmarosa, germination, foliage yield, essential oil, geraniol

Introduction

Palmarosa, *Cymbopogon martini* var. *motia* is a tall perennial aromatic crop which has more demand in perfume industries due to its sweet-smelling oil of rose note. It is also known as East Indian Geranium or Russa grass. It is native to India. It belongs to the family, poaceae with chromosome number of 2n=20. It is a tropical plant and grows in warm humid areas. But it is cultivated in tropical and sub-tropical areas of the world (Sangwan *et al*., 2001). In India, it grows wild in Madhya Pradesh, Maharashtra, and Andhra Pradesh. It is also grown in Karnataka, Tamil Nadu, Rajasthan, Odisha and Uttar Pradesh. It is a cheap source an essential oil with high grade geraniol (60-90%), geranyl acetate and linalool. It is used worldwide in perfume, cosmetic industries, food flavouring and medicinal pharmaceutical industries due to its aroma are similar to that of rose (Verma *et al*., 2010; Sahu *et al*., 2000). Essential oil has antifungal (Zhian Kou *et al*., 2023), antibacterial (Lodhia *et al*., 2009), anthelmintic properties (Nirmal *et al*., 2007) and antioxidant activity (Sinha *et al*., 2011; Lawrence and Charan, 2012). Palmarosa oil is an active component of mosquito repellents (Das and Ansari, 2003), soaps and detergents. India is a major producer and exporter of palmarosa oil. Geraniol is an excellent extender in many floral, rose-like perfumes and base material for the production of aroma chemicals particularly geranyl esters that have a lasting rose-like aroma (Kumar *et al*., 2012).

Palmarosa is a hardy, cross pollinated crop which can be grown in wide range of soil and climatic conditions. It can tolerate drought and grown in saline, alkali and sodic soil. It produces an economic yield on alkaline soils of pH up to 9 although it grows best on soils having neutral pH. It is a profitable crop with benefit cost ratio of 2.59 (Suresh *et al*., 2014). Biosynthesis of secondary metabolites is influenced by salt stress resulting in considerable increase in quality and quantity of essential oil. The proportion of components in the essential oil decides the quality of oil. In this situation, screening of palmarosa is needed for identifying the saline tolerant/resistant lines to stabilize/increase the yield in salt affected soils. With this background, this research work was carried out to screen different palmarosa accessions in salt affected soil.

Materials and Methods

The present study was conducted at Horticultural College and Research Institute for Women, Tiruchirappalli, Tamil Nadu to screen palmarosa accessions under salt affected soil. Palmarosa seeds *viz*., Trishna, Tripta, CIMAP Harsh, Vaishnavi, PRC-1, Haryana No. 49 and local types from Coimbatore, Gujarat and Thuraiyur were collected.

Palmarosa accessions

S. No.	Accession number	Name of the accessions
1.	CMM 1	Trishna
2.	CMM 2	Tripti
3.	CMM 3	Vaishnavi
4.	CMM 4	PRC-1
5.	CMM 5	CIM Harsh
6.	CMM 6	Coimbatore local
7.	CMM 7	Haryana 49
8.	CMM 8	Gujarat local
9.	CMM 9	Local type from Thuraiyur

Seeds of all accessions were mixed with sand in a ratio of 1:10 and sown in beds during May-June. Seeds started germinating in 4-5 days. Watering and weeding were done regularly. After main field preparation and farm yard manure application, the beds were formed. The seedlings of 35 days old were transplanted on ridges in three replications at spacing of 60 x 45 cm. First cutting was done after 4 months of planting. The subsequent cutting was done at an interval of 2 months. The observations recorded on plant height, establishment, plant height, number of tillers/plants, foliage yield, oil yield and geraniol content were subjected to statistical analysis (Panse and Sukhatme, 1985).

Results and Discussion

Analysis of soil and irrigation water

Initial soil and water analysis was carried out. pH and electrical conductivity of the soil was 8.47 and 2.25 dS/m, respectively. Exchangeable Sodium Percentage in initial soil was 14.8. pH and electrical conductivity of water was 8.3 and 1.76 dS/m, respectively. Residual sodium carbonate of water was 11.2. Available nitrogen in soil was recorded as 176 kg/ha. Available phosphorus in the soil was 24 kg/ha. Available potassium was 253 kg/ha. Elevated potassium level accelerated many biochemical reactions and led to the greater number of tillers, essential oil yield and quality.

Studies on salt tolerance

To study the salt tolerance, the seeds of palmarosa var. Vaishnavi were dipped in 10 ppm GA_3 solution. After germination, 10 germinated seeds were kept in the plates containing 0, 1, 2, 3, 4 and 5% NaCl solution. The seedling growth was observed for 5 days. All the seedlings were healthy. Seedling growth was better up to 5 % NaCl (Figure 1).

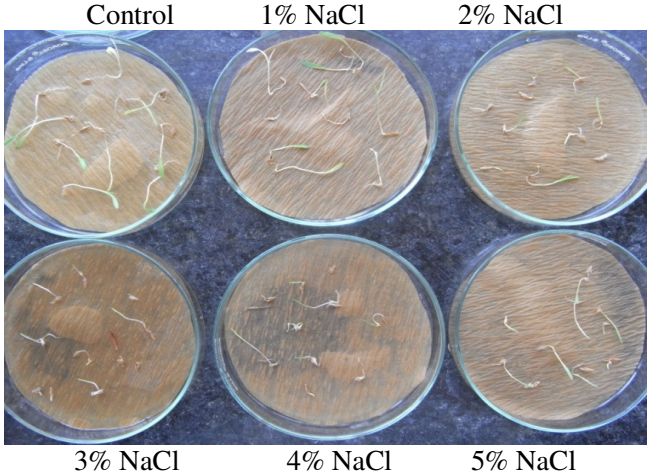

Fig. 1 : Palmarosa seedling growth in different concentration of NaCl

Growth and yield of palmarosa

Nine accessions of palmarosa were transplanted in the field with plot size of 4x3. It was observed that the establishment was significantly better in CMM 5 (82.10%) followed by CMM 3 (80.60%) whereas the establishment was low in Coimbatore local (Table 1). The number of tillers was significantly higher in CMM 4 (39.33) and CMM 1 (39.00). The smaller number of tillers were recorded in CMM 2 (33.00) and CMM 6 (34.33). The plant height was significantly higher in CMM 3 (146.00 cm) and CMM 4 (145.00 cm) followed by CMM 5 (140.33 cm). The plant height was less in CMM 1 (90.67 cm). The plant height was influenced by genotypes (Smitha and Dhaduk, 2018). The yield/plot was recorded significantly higher in CMM 3 (7.10 kg) followed by CMM 5 (6.90 kg). The roots are shallow and fibrous. Culms were erect with swollen nodes. There was not any pest and diseases observed. Fresh and dry herbage yield showed a significant positive correlation with plant height, the number of tillers and oil yield (Smitha and Manivel, 2021) and a significant correlation of oil yield with plant height and number of tillers.

Table 1 : Growth parameters and yield of Palmarosa, *Cymbopogon martinii* var. *motia*

S.No.	Accession No.	Accession name	Establishment (%)	Plant height (cm)	No. of tillers/plant	Yield (kg/plot)
1.	CMM 1	Trishna	76.80	90.67	39.00	6.27
2.	CMM 2	Tripti	72.50	111.67	33.00	6.57
3.	CMM 3	Vaishnavi	80.60	146.00	37.33	7.10
4.	CMM 4	PRC-1	62.20	145.00	39.33	6.00
5.	CMM 5	CIM Harsh	82.10	140.33	38.00	6.90
6.	CMM 6	Coimbatore local	52.30	115.67	34.33	5.77
7.	CMM 7	Haryana 49	76.60	110.00	36.00	6.47
8.	CMM 8	Gujarat local	79.30	141.29	32.11	6.14
9.	CMM 9	Local type	74.20	134.58	35.72	6.75
	Mean		73.00	126.10	36.09	6.44
	SEd		**0.75**	**11.10**	**0.24**	**0.04**
	CD (5%)		**1.51**	**23.41**	**0.49**	**0.09**

Essential oil and geraniol content

The crop was harvested at full flowering and seed formation stage. The harvesting was done using sickle at 20 cm above the ground level. The floral parts with 40-60 cm long inflorescence panicles and foliage are used for distillation of essential oil in Clevenger type apparatus. The geraniol content of essential oil was estimated using GC-MS (Table 2).

Table 2 : Essential oil yield and geraniol content of Palmarosa, *Cymbopogon martinii* var. *motia*

S.No.	Accession No.	Accession name	Essential oil yield (kg/plot/harvest)	Essential oil yield (kg/acre/year)	Geraniol (%)
1.	CMM 1	Trishna	0.038	75.3	76.7
2.	CMM 2	Tripti	0.040	80.5	73.2
3.	CMM 3	Vaishnavi	0.047	93.6	79.1
4.	CMM 4	PRC-1	0.045	90.1	78.6
5.	CMM 5	CIM Harsh	0.054	108.5	81.2
6.	CMM 6	Coimbatore local	0.035	70.9	76.5
7.	CMM 7	Haryana 49	0.040	80.4	73.1
8.	CMM 8	Gujarat local	0.039	78.6	72.0
9.	CMM 9	Local type	0.044	88.1	77.4
	Mean		0.042	85.11	76.42
	SEd		**0.11**	**5.34**	**1.56**
	CD (5%)		**0.21**	**10.77**	**3.12**

The essential oil was significantly higher in CMM 5 (0.054 kg/plot/harvest; 108.5 kg/acre/year) followed by CMM 3 (0.047 kg/plot/harvest; 93.6 kg/acre/year). There was a difference recorded in geraniol content of essential oil in palmarosa accessions. Geraniol content was significantly higher in CMM 5 (81.2%) followed

by CMM 3 (79.1%). Essential oil yield and chemical composition of oil varied with location where it is cultivated with suitable temperature in Ranga reddy district favours the accumulation of higher biomass and good quality oil (Jnanesha *et al*., 2019). Smitha and Dhaduk, 2018 reported that Udaipur chemotype recorded the highest dry biomass yield, essential oil content and essential oil yield (0.67 kg/pt, 1.04% and 6.97 mg/pt, respectively) compared to PRC 1 (0.52 kg/pt, 0.93% and 4.8 mg/pt, respectively). Geraniol content in PRC 1 was recorded as 78.29±1.95 % (Smitha and Dhaduk, 2018). Rajeswara Rao *et al*., 2009 reported that leaf lamina and leaf sheath oils were richer in palmarosa and reported geraniol content as 70.1–85.3%.

Conclusion

Palmarosa is a hardy crop which can be grown on wide range of soil and climatic conditions. The establishment of palmarosa accessions was significantly better in salt affected soil. The plant height was significantly higher in CMM 3 (146.00 cm) and CMM 4 (145.00 cm) followed by CMM 5 (140.33 cm). The yield/plot was recorded significantly higher in CMM 3 (7.10 kg) followed by CMM 5 (6.9 kg). The essential oil was significantly higher in CMM 5 followed by CMM 3. Similarly, geraniol content was significantly higher in CMM 5 (81.2%) followed by CMM 3 (79.1%). There is a great scope for cultivation of palmarosa profitably in salt affected soils.

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