Identification of salt tolerant sesame (*Sesamum indicum* L.) genotypes under *invitro* condition

Abstract:

Sesame has adaptability to a wide range of climates and soil concludes and its cultivation may be an alternative option in areas with salinity problems. However, the performance of this plant in salinity stress environment, and the evaluation of germplasm from different places with diseases morphological and physiological features have not been studied well. It would lead to selection of parents for future crossing programme in the breeding process. Based on overall observations, the sesame genotype, VS-20-042 is identified as more saline tolerant followed by the genotypes Kattikulam local, TMV3, VS-20-078 and VS-20-008. The sesame variety VRI 4 is moderately sensitive to salinity followed by the genotype VS-20-054 and VS-21-060. The sesame genotypes, SVPR 1, Swetha, VRI 2 and VS-20 -005 are selected as highly salt sensitive. From this study it is concluded that the identified salt tolerant sesame genotypes *viz.*, VS-20-042, Kattikulam local, TMV3, VS-20-078 and VS-20-008 may be used as salt tolerant donor in salt stress tolerance breeding programme.

Key words: Sesame, salinity, *invitro*

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Introduction

Food security is becoming significantly important become of growing population and climate change. Drought and salinity are becoming increasingly common, particularly in arid and semi- arid regions. Therefore, crop irrigation scheduling and farm water management must be optimized to promote food securely and farmers, better livelihood (Fuji maki *et al.,* 2020). Salinization is recognized to be among the most severe soil degradation factor in arid and semi-arid region has drastically decreased in recent years, imposing additional obstacles to agricultural production. Crop densification through the cultivation of salt and drought-tolerant unconventional crops could be an option to sustain the productivity of salt-affected dry lands. This can be achieved by integrating new genetically improved lines with high-yield and quality-promoting traits into a saline agricultural production system.

Sesame (Sesamum *indicum* L.) is the fifth important oilseed crop in India after groundnut, Soyabean, Sunflower and rapeseed- mustard (supportive reference?).- Sesame seeds

are contained manganese, iron, zinc and fibres (supportive reference?). Sesame oil is considered to be the best edible oil in India, which is having antioxidants such as sesamin, sesamol, sesamolin *etc*. and up to 80% of the total fatty acid is unsaturated fatty acids (Nupur *et al.*, 2010). The oil contains sesaminol and sesamin lignans that play an important role in the activity of tocopherols and other antioxidants (Lee *et al.* 2008). The oil extracted from its seeds can be used in the manufacturing of pies, margarine, perfumes, lubricants, medicines and soap.

Besides the nutritional importance, Sesame stands out in terms of good production stability relative to the water factor (low water requirement) compared to other cultivated species Sesame is more adaptable to a broad range of soil types (Islam *et al.*, 2016). This quality raised sesame as an attractive crop specially designed for challenging climate changes (Li *et al.* 2018) although salt stress is a serious factor affecting productivity (Bahrami *et al.*, 2016 and Zhang *et al.*, 2020). With this point of view, the present study was carried out to identify salt tolerant sesame genotypes under *invitro* condition.

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Materials and Methods:

The present study was conducted at a Research laboratory in the Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai, during the year 2024. About twenty sesame genotypes *viz*., VRI-1, VRI-2, VRI-3, VRI-4, VRI-5, TMV-3, TMV-6, Swetha, GT-10, SVPR-1, Kattikulam local, Aritapatti local, VS-19-054, VS-20-054, VS-20-078, VS-21-042, VS-21-060, VS-20-008, VS-20-040 and VS-20-005 and mature and healthy seeds were placed under *invitro* condition using roll towel method. Four treatments were formulated along with control (control, 50mM, 100mM, 150mM) and for each treatment, fifteen seeds were used with two replications and observations were recorded for six biometric traits *viz*., germination percentage, shoot length(cm), root length (cm), seedling height (cm), root to shoot ratio and vigour index (Table.).

Commented [bp4]: On what basis these genotypes were selected? Are these good performers under normal conditions or something else like this. Please provide the basis of selection of these genotypes. Also, if any check variety included please highlight/differentiate it from genotypes

Commented [bp5]: Table no. ?. What statistical methods were used to analyse the data, please mention

Results and Discussion:

Effect of salinity on Germination percentage:

The salinity treatments negatively influenced the germination percentage. When salinity increased, the germination percentage decreased in all the sesame genotypes. All the genotypes showed different germination percentage in different levels of salinity. At higher salt

concentration of 150mM level, the highest germination percentage (76.0%) was recorded by the genotype Kattikulam local, followed by VRI 5 (71.0%) sesame variety, whereas the lowest of 53.0–% germination percentage was recorded by the genotypes VS-20 -054 and VS-20 -054 followed by the genotypes VRI 3 (54%) and VS -20- 078 (54%). Hence, the sesame genotypes, Kattikulam local, TMV 6, Swetha, GT 10, and SVPR 1, are identified as more salt-tolerant types. The sesame genotypes VRI 4, VS-20-008, VS-21-060, VRI 2, TMV 3, VS-21-042, and VS-20-040 are moderately sensitive to salinity whereas the sesame genotypes VS-20-054, VS-20-078, VS -19-054, VRI 3, Aritapatti local and VS-20-005 are more sensitive to salinity.

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Effect of salinity on Shoot length:

The shoot length was reduced with increasing NaCl concentration in all the sesame genotypes studied in this experiment. In higher NaCl concentration (150mM), the maximum shoot length (7.5cm-) registered by the three sesame entries (VRI 1, Kattikulam local and VS-20-078-) followed by the two genotypes (VS-20-054 and VS-21-042-) expressed shoot length of 7.0 cm. By considering overall reduction of shoot length at higher NaCl concentration level, the sesame genotypes, VS-20-078, VS-21-042, VS-20-008 and Kattikulam local and more salt tolerant genotypes than others. The six sesame genotypes *viz.*, VRI 4, GT 10, SVPR 1, VS-20-005, Aritapatti local, and VRI 2 are highly sensitive to salinity.

Effect of salinity on Root length:

In 150 mM NaCl concentration treatment the highest root length of 4.0cm was registered by the four genotypes viz., TMV3, VS-20-054, VS-21-042 and VS-20-040 whereas the lowest root length (2.0cm) recorded by the two local and sesame genotype (Kattikulam local and Aritapatti local) followed by the root length of 2.5cm expressed by six sesame genotypes *viz.*, VRI 1, TMV 6 , Swetha , GT 10 , SVPR 1 and VS-20-078. When taken in account of overall all reduction in root length the sesame genotypes VS-20-040, VS-21-042, TMV 3, VRI 3, VS-20-054 and VS-20-078 are more salt tolerant types, the sesame genotypes VRI 3, VRI 4, TMV 6, Kattikulam local, VS-20-005, VRI 2, SVPR 1 are highly sensitive to salinity.

Effect of salinity on Seedling height:

In the highest concentration of salt treatment, the maximum seedling height of 8.0cm was exhibited by the five genotypes viz., Swetha, GT-10, SVPR-1, Aritapatti local, and VS-19-054

followed by the two genotypes (VRI 2 and VS-20-005) expressed the seedling height of 8.5cm. The maximum seedling height of 11.0cm registered by the two genotypes VS-20-054 and VS-21-042 followed by seedling height of 10.0cm registered by the four sesame genotypes (VRI 1, VRI 4, TMV 3 and VS-21-060). By considering overall reduction percentage of seedling the sesame genotypes V-21-042, TMV 3, VS-20-054, VS-20-040, VS-20-078, Kattikulam level, VRI 3, VS-21-060 and VS-20-008 are salt tolerant types. The sesame genotypes, VRI 1, VRI 4, TMV 6, Arititapatti local and VS-19-054 are moderately sensitive and VRI 2, VRI 5, Swetha, GT 10 and SVPR 1 are more sensitive to salinity.

Effect of salinity on Root shoot ratio:

In 150mM NaCl salt treatment, the maximum root to shoot ratio (0.66) exhibited by the two sesame genotypes *viz.*, TMV 3 and VRI 5, VS-20-040 followed by the sesame genotype VS-19-054 recorded to shoot ratio of 0.60. The maximum root to shoot ratio (0.26) recorded by the local sesame genotypes (Kattikulam local) followed by Aritapatti local (0.30), VRI 1 (0.33) and VS-20-078 (0.38). When taken into account of overall reduction of root to shoot ratio of the sesame genotypes VS-20-040, TMV 3, VRI 3, VRI 2, VS-21-042 and VS-20-054 are more salt tolerant types when compared to other sesame genotypes. The sesame genotypes VRI 4, TMV 6, VS-21-060 and VS-20-005 are moderately sensitive to salinity whereas the sesame genotypes VRI 1, GT 10, VS-20-00, SVPR 1, Kattiulam local and Swetha are highly sensitive to salinity.

Effect Of salinity on Vigour Index:

In the high salt treatment level (150mM), the maximum vigour index 725 exhibited by the sesame genotype VS-21-042 followed by the vigour index of 722 registered by the sesame local genotype kattikulam local. Whereas the minimum vigour index of 448 expressed by the Sesame genotype VS-19-054 followed by the local sesame genotype Aritapatti local registered vigour index of 496.

By considering overall reduction percentage of vigorous index, the sesame genotypes TMV3, Kattikulam local, VS-21-042, VS-20-008, VS-21-060, VRI 3 and TMV 6 are more salt tolerant types the sesame genotypes VS-21-042, VS-20-054, GT 10, SVPR 1 are moderately

sensitive to salinity whereas the sesame genotypes VRI 1, VRI 2, VRI 5, VS-19-054 and VS-20-005 are more sensitive to salinity.

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Conclusion

Based on overall performance of sesame genotypes, the line VS-20-042 is the more saline tolerant one followed by the genotypes Kattikulam local, TMV3, VS-20-078 and VS-20-008. The sesame variety VRI 4 is moderately sensitive to salinity followed by the genotype vs-20-054 and VS-21-060. The sesame genotypes, SVPR 1, Swetha, VRI 2 and VS-20 -005 are highly salt sensitive. From this study it is concluded that the identified salt tolerant sesame genotypes viz., VS-20-042, Kattikulam local, TMV3, VS-20-078 and VS-20-008 may be used as salt tolerant donor in salt stress tolerance breeding programme.

Commented [bp8]: Based on limited seed-related parameters and data from a single season, we cannot definitively declare whether a genotype or variety is tolerant or susceptible

References

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Table 1. Effect of higher salt concentration on sesame genotypes

S.N o	GENOTYPE	I	II	III	IV	V	VI
1.	**VRI-1**	56.0	7.5	2.5	10.0	0.33	560.0
2.	**VRI-2**	63.0	5.5	3.0	8.5	0.54	535.5
3.	**VRI-3**	54.0	6.0	3.5	9.5	0.58	513.0
4.	**VRI-4**	67.0	6.5	3.5	10.0	0.53	670.0
5.	**VRI-5**	71.0	6.0	3.0	9.0	0.50	639.0
6.	**TMV-3**	58.0	6.0	4.0	10.0	0.66	580.0
7.	**TMV-6**	65.0	6.5	2.5	9.0	0.38	585.0
8.	**SWETA**	67.0	5.5	2.5	8.0	0.45	536.0
9.	**GT-10**	65.0	6.5	2.5	8.0	0.38	520.0
10.	**SVPR-1**	66.0	6.5	2.5	8.0	0.38	528.0
11.	**Kattikulam local**	76.0	7.5	2.0	9.5	0.26	722.0
12.	**Aritapatti local**	62.0	6.0	2.0	8.0	0.30	496.0
13.	**VS-19-054**	56.0	5.0	3.0	8.0	0.60	448.0
14.	**VS-20-054**	53.0	7.0	4.0	11.0	0.57	583.0
15.	**VS-20-078**	54.0	7.5	2.5	9.5	0.36	513.0
16.	**VS-21-042**	66.0	7.0	4.0	11.0	0.57	726.0
17.	**VS-21-060**	64.0	6.5	3.5	10.0	0.53	640.0
18.	**VS-20-008**	67.0	6.5	3.0	9.5	0.46	636.5
19.	**VS-20-040**	62.0	6.0	4.0	10.0	0.66	620.0
20.	**VS-20-005**	61.0	5.5	3.0	8.5	0.54	518.5
	Mean	**62.7**	**6.4**	**3.0**	**9.3**	**0.5**	**578.5**
	SEd	**17.58**	**0.64**	**0.98**	**1.15**	**0.11**	**13.64**
	CD(5%)	**51.97**	**1.89**	**2.89**	**3.41**	**0.33**	**40.31**
	CV %	**41.54**	**29.53**	**14.83**	**23.51**	**2.65**	**2.98**

I- Germination percentage
II- Shoot length (cm)
III- Root length (cm)
IV- Seedling height (cm)
V- Shoot to root ratio
VI- Vigour Index