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Evaluation of Genotypes for high Yield and Quality in Bitter Gourd (*Momordica Charantia* L.) under Sodic Soils of Tamil Nadu

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ABSTRACT

Bitter gourd (*Momordica charantia* L.), a monoecious annual vine of Cucurbitaceae family is cultivated for its edible fruits. The experiment was carried out at Department of Vegetable Science, Horticulture College and Research Institute for Women, Tiruchirappalli during 2021-2023 with 31 bitter gourd genotypes laid out in randomised block design. Genotypes were evaluated under the sodic soils for the growth characters *viz.,* vine length (cm), number of node at first male flower emergence, number of node at first female flower emergence; yield characters *viz.,* number of days for first harvest, single fruit weight (g), fruit yield (g vine^{-1}), number of fruits per plant and quality parameter *viz*., total phenol content (mg GAE g^{-1}) and vitamin C content (mg 100g^{-1}). The results envisaged that among the 31 genotypes, the genotype MCPKM-04 observed for higher yield per vine (2422.80 g). The genotype MCPKM-19 was superior in terms of earliness (61.00 DAT) while MCPKM-05 performed better for vitamin C content (102.34 mg 100g^{-1}) and total phenol content (34.13 mg GAE g^{-1}) under sodic conditions. Selection of bitter gourd among the diverse genotypes with higher yield and quality necessarily help in various crop improvement programs.

Key Words: Bitter gourd, Genotypes, Growth, Sodic soil, Total phenol

INTRODUCTION

Bitter gourd botanically known as *Momordica charantia* L. is cultivated under the tropical and subtropical areas. In India, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Tamil Nadu and Orissa are the leading producer of bittergourd contributing more than half of the nation's total production. Fruits are the rich source of vitamins and minerals such as thiamine, beta-carotene, folate, riboflavin, zinc and potassium. Bioactive compounds such as polypeptides, alkaloids, minerals and vitamins were present in the fruit. The bitter principle present in the fruits are charantin, karavilosides, glycosides, vicine and along with plant insulin and polypeptide-p. They work as hypoglycemic agents as they raise blood sugar levels by stimulating the fat cells, muscles and liver to absorb more glucose and synthesize more glycogen. (Harinantenaina *et al,* 2006).

The genus *Momordica* consist about 59 number of species where 47 species were from Africa and 12 species were from Asia and Australia (Schaefer and Renner, 2010). Among the different species, charantia and muricata types were commercially cultivated. Sodicity is one among the serious abiotic stress factor that could limit the production. In India, salt-affected soils make up about 67.3 lakh hectares of land, of which 29.6 lakh hectares were impacted by sodicity. Due to aberration in the soil physical property, the crop production under sodic soil is hindered greatly that causes poor aeration and poor root development. Development of a good resistant variety for sodic soil will be the ideal solution. Naturally bitter gourd is sensitive to sodicity and there exist a need to evaluate the various genotypes under sodic soil to identify the best performing line. Evaluation of genotypes is the prerequisite for genetic diversity studies and helps in identifying best parents for further hybridization program. The experiment focuses on the evaluation of different bitter gourd genotypes under sodic soil to identify the best performing genotypes.

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MATERIALS AND METHODS

The experiment was carried out at Department of Vegetable Science, Horticulture College and Research Institute for Women, Tiruchirappalli during 2021-2023. The site receives an annual rainfall of about 841.90 mm with annual mean temperature of 25°C to 32°C. The experiment consists of 31 genotypes laid out in Randomised block design and each were replicated thrice. Table 1 depicts the number of genotypes and their source of collection. The seeds were sown under protray and transplanted uniformly in the main field of 0.40 ha at the spacing of 2.00 m x 1.50 m. The plants were irrigated through drip at daily interval until germination and later irrigated at an interval of three days. Nutrients were supplied through fertigation technique at the rate of 200:100:100 kg/ha. The production practices followed were as per TNAU crop production guide. The texture of the soil was sandy loam texture with 9.2 pH. The observations *viz.,* vine length (cm), number of node at first male flower emergence, number of node at first female flower emergence, number of days for first harvest, single fruit weight (g), fruit yield (g vine^{-1}), number of fruits per plant, total phenol content (mg GAE g^{-1}) and vitamin C content (mg 100g^{-1}) were recorded. Five plants were selected random for all treatments in each replication. Vitamin C content was analysed as per the procedure mentioned in Ranganna (2001). The phenol content in the fruit was determined using Spectrophotometer as mentioned by Horax *et al* (2005). Two seasons data were pooled and analysed statistically (Panse and Sukhatme, 1985) using ANOVA table to determine the significant differences among the genotypes.

RESULTS AND DISCUSSION

The data (Table 1) showed that significant variation exist for vine length (cm), number of node at first male flower emergence, number of node at first female flower emergence, number of days for first harvest, single fruit weight (g), fruit yield (g vine^{-1}), number of fruits per plant and total phenol content (mg GAE g^{-1}) among the genotypes since the analysis of variance exhibited significant difference for the genotype mean sum of square (Table 2). This inferred that there exists significant scope for crop improvement in bitter gourd. All the above characters in bitter gourd greatly influenced the growth, yield and quality. The present observations were similar with Yadav *et al* (2013) in bitter gourd.

Vine length

Vine length decides the growth of a crop and is an important criterion in the selection of variety. It was found that genotype MCPKM-12 attained the highest vine length of 540.00 cm followed by MCPKM-23 of 485.00 cm while the lowest vine length was recorded in HC RI (W) Try-2 (268.50 cm). This was in agreement with findings of Saranyadevi *et al* (2017).

Earliness

Earliness is one among the desirable trait in any of the crop improvement program. The adaption of crop to a new environment and new cropping system relies on the earliness of a crop (Kumar and Abbo, 2001). The response of a crop to various biotic and abiotic stress also depends upon the earliness (Owusu *et al,* 2022). The occurrence of first male flower was observed on the 6th node for the genotypes *viz.,* MCPKM-5, MCPKM-12, MCPKM-19, MCPKM-26 followed by 7th node for the genotypes *viz.,* MCPKM-4, MCPKM-9, MCPKM-23 and MCPKM-24 while the genotype MCPKM-16 recorded the first male flower appearance at the 17th node. The occurrence of first female flower was noticed at 10th node in MCPKM-04 followed by the occurrence of first female flower at 11th node in MCPKM-12 whereas the occurrence of female flower was noticed at 23rd node in HC&RI (W) Try-2.

The genotype MCPKM-19 found for the early harvest (61.00 DAT) followed by MCPKM-23 (61.50 DAT) while the genotype MCPKM-18 recorded maximum days for harvest (78.50 DAT). This inferred that MCPKM-19 adapted well to the changing environment and exhibits some level of tolerance towards abiotic and biotic stress.

Yield

The crop yield is one among the primary trait in any crop improvement program. Single fruit weight, fruit yield and number of fruits per plant are the yield contributing attributes and hence decides the superiority of a crop. The increased number of fruits per plant was noticed in genotype MCPKM-04 (18.00) followed by 16 numbers of fruits in four genotypes *viz.,* MCPKM-01, MCPKM-05, MCPKM-19, MCPKM-24. The lowest number of fruits (9.00) were exhibited in two genotypes *viz.,* MCPKM-09, MCPKM-10. The findings in ridge gourd by Prabha *et al* (2007) attained similarity with the present results.

Single fruit weight recorded maximum in the genotype MCPKM-26 (140.80 g) followed by MCPKM-05 (137.50 g). The genotype MCPKM-22 recorded for the minimum single fruit weight of 46.00 g. Singh *et al* (2017) reported the same in bitter gourd. Fruit yield increased in the genotype MCPKM-04 (2422.80 g/vine) followed by the genotype MCPKM-05 (2200.00 g vine^{-1}) whereas the fruit yield decreased in the genotype MCPKM-22 (414.00 g vine^{-1}). The decreased fruit weight might be the reason for minimum fruit yield in MCPKM-22. Fruit yield depends on the single fruit weight and number of fruits per plant. The same was reported in bitter gourd by Chaubey and Ram (2004), Behera *et al* (2006) and Rani (2014); sugar beet by Sanghera *et al* (2016) and bottle gourd by Sharma *et al* (2019).

Vitamin C content observed highest in the genotype MCPKM-05 (102.34 mg/100g) followed by MCPKM-04 (99.76 mg/100g). The lowest vitamin C content was observed in MCPKM-22(67.24 mg/100g). The findings of Singh *et al* (2017) in bitter gourd was in accordance with the present results. Bitter gourd is rich in phenols where the major phenolic compounds were gallic acid and caffeic acid (Kubola and Siriamornpun, 2008). They were mostly accumulated in the flesh, aril and seeds of bitter gourd. These phenolic compounds considered as the ideal antioxidant source and so could be used in food system. The total phenol content observed the highest in MCPKM-05 (34.13 mg GAE g^{-1}) followed by MCPKM-19 (32.46 mg GAE g^{-1}) whereas the total phenol content observed lowest in MCPKM-22 (13.24 mg GAE g^{-1})

CONCLUSION

The present investigation concluded that the genotypes *viz.,* MCPKM-04, MCPKM-05, MCPKM-19 and MCPKM-26 exhibited for the superior performance over other genotypes for the growth, yield and quality traits under sodic soils. These genotypes could be recommended as the best lines for the future hybridization works.

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Table 1. Performance of the genotypes under sodic soil.

Genotype	Vine Length (cm)	Number of node at first male flower emergence	Number of node at first female flower emergence	Number of days for first harvest	No. of Fruits per plant	Single Fruit Weight (g)	Fruit yield (g vine^{-1})	Vitamin C content (mg 100g^{-1})	Total phenol content (mg GAE g^{-1})
MCPKM-01	346.00	8.00	16.00	71.20	16.00	81.00	1296	90.34	28.11
MCPKM-02	353.00	8.00	16.00	69.60	12.00	97.42	1169.04	86.82	24.43
MCPKM-03	402.00	8.00	17.00	73.00	9.00	76.33	686.97	87.22	21.12
MCPKM-04	408.00	7.00	10.00	67.00	18.00	134.60	2422.8	99.76	30.44
MCPKM-05	426.00	6.00	12.00	66.50	16.00	137.50	2200	102.34	34.13
MCPKM-06	401.00	8.00	18.00	72.30	9.00	87.50	787.5	73.50	18.75
MCPKM-07	248.00	9.00	16.00	69.40	10.00	83.50	835	70.67	15.45
MCPKM-08	402.00	9.00	14.00	70.20	8.00	132.33	1058.64	79.11	20.11
MCPKM-09	438.00	7.00	21.00	71.10	7.00	106.00	742	83.25	23.91
MCPKM-10	392.00	9.00	18.00	69.00	7.00	60.00	420	82.58	25.73
MCPKM-11	333.00	13.00	15.00	70.00	9.00	67.50	607.5	77.90	17.11
MCPKM-12	540.00	6.00	11.00	65.00	15.00	132.32	1984.8	97.62	31.32
MCPKM-13	363.00	13.00	20.00	72.30	9.00	130.33	1172.97	90.15	25.11
MCPKM-14	396.00	9.00	21.00	75.30	14.00	93.00	1302	89.54	20.51
MCPKM-15	363.00	11.00	17.00	72.60	8.00	99.33	794.64	85.72	22.41
MCPKM-16	373.00	17.00	22.00	75.80	10.00	102.00	1020	88.10	26.73
MCPKM-17	391.00	13.00	18.00	71.30	14.00	50.00	700	75.83	24.65
MCPKM-18	335.00	13.00	18.00	78.50	9.00	103.33	929.97	79.45	29.11
MCPKM-19	427.00	6.00	12.00	61.00	16.00	132.00	2112	96.50	32.46
MCPKM-20	366.00	12.00	18.00	70.00	9.00	87.00	783	92.10	29.42
MCPKM-21	340.00	6.00	15.00	72.30	8.00	129.50	1036	84.83	20.98
MCPKM-22	363.00	15.00	15.00	74.10	9.00	46.00	414	67.24	13.24
MCPKM-23	485.00	7.00	12.00	61.50	15.00	131.33	1969.95	70.11	29.99
MCPKM-24	411.00	7.00	13.00	67.50	16.00	134.60	2153.6	90.51	30.01

Table 2. ANOVA for different characters of bitter gourd genotypes.

Character	Replication MSS	Genotype MSS	Error MSS
Vine Length	10.10	12689.90**	98.30
Number of node at first male flower emergence	0.04	32.722**	0.07
Number of node at first female flower emergence	0.13	31.68**	0.13
Number of days for first harvest	5.76	49.30**	3.66
Number of fruits per plant	0.01	30.77**	0.11
Single Fruit Weight	2.33	2361.33**	8.65
Fruit yield	348.00	984425.00**	1553.00
Vitamin C content	8.13	223.53	3.65
Total phenol content	0.68	89.03**	0.38

MSS- Mean Sum of Squares
**- significant at 0.01

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