



## RESEARCH PAPER

# Evaluation of scented geranium accessions for morphological and yield attributes in southern Indian conditions

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**Abstract :** Scented geranium (*Pelargonium* spp.: Geraniaceae) is an important, high value aromatic crop of South African origin. The oil of geranium is obtained by steam distillation of tender plant parts. More than 120 constituents are identified in the oil. Due to high demand and price for the oil, an excellent potential exists for increasing cultivated area in India. An attempt was made to evaluate and characterize the available accessions of scented geranium based on their morphology and yield attributes. There were seven treatments and four replications. PG-12 recorded maximum plant height (53.45 cm), PG-1 recorded maximum plant spread (6706.43 cm<sup>2</sup>), PG-12 registered maximum number of leaves (469.20), PG-11 recorded the highest (12.35 mm) stem diameter. Flowering was observed in the accessions PG-1, PG-8, PG-10, KB and CIMAP though the extent varied widely. KB recorded the maximum herb yield per plant, per plot and per hectare (0.69 kg, 13.90 kg and 19.30 t, respectively). PG-8 registered the maximum oil content (0.437%), KB recorded the maximum essential oil (2.07 ml, 41.43 ml and 57.53 l, respectively) per plant, per plot and per hectare oil yield. So, KB and PG-8 were found best among all for their essential oil yield and quality.

**Key Words :** Geranium, Accessions, Evaluation

**View Point Article :** Harish, B.S., SINGH, V. P., Kumar, T. Vasant, Vishwanath, Y. C. and Sakhubai, H.T. (2018). Evaluation of scented geranium accessions for morphological and yield attributes in southern Indian conditions. *Internat. J. agric. Sci.*, **14** (1) : 65-69, DOI: 10.15740/HAS/IJAS/14.1/65-69.

**Article History :** Received : 04.10.2017; Revised : 08.11.2017; Accepted : 21.11.2017

## INTRODUCTION

Scented geranium (*Pelargonium* spp. Geraniaceae) is an important, high value perennial aromatic crop of South African origin, that was introduced into India during 1900-1915 AD by French planters and got acclimatized to South Indian climate.

The oil has a fine rosy odour and a rich long lasting sweet rosy dry out note (Sastry *et al.*, 2000). More than 120 constituents were identified in the oil, the major ones

being citronellol, geraniol, linalool, isomenthone, citronellyl formate, citronellyl acetate, geranyl formate, geranyl acetate, guaia 6, 9-diene, 10-epi- $\gamma$ - eudesmol etc. due to high demand and price for the oil, an excellent potential exists for increasing cultivated area in India (Rao, 2000). Most of the Indian production comes from Tamil Nadu (1.5 t oil from 125 ha), whereas the rest is produced in the plains of Andhra Pradesh (< 20 ha), Karnataka (< 20 ha) and Uttar Pradesh (< 5) (Rao, 2000). In India the

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productivity varies from 30-50 t of herb per hectare, 0.06 to 0.1 per cent oil recovery and 30-50 kg oil per hectare (Singh *et al.*, 2000).

The availability information on varietal evolution is very limited in this crop. Evaluating the available genotypes for their various characteristics is of prominent importance. Presently, the classification of geranium is based on morphology and/or chemical composition of the oil. The morphological characteristics and physico-chemical properties of the oil are key issues in characterizing the genotypes / accessions.

## MATERIAL AND METHODS

For morphological evaluation, the experiment was conducted at the Division of Horticulture, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bangalore.

The experiment was conducted using seven geranium accessions, which are shown in Table A.

Sr. No.	Accession (Treatment)	Source
1.	PG-1	IIHR
2.	PG-8	IIHR
3.	PG-10	IIHR
4.	PG-11	IIHR
5.	PG-12	IIHR
6.	CIMAP collection	GKVK-CIMAP
7.	Kodiakanal Bourbon	IIHR-HRS, Kodiakanal

### Design and layout :

Treatments :	Seven
Replications :	Four
Plot size :	3 M x 2.4 M
Fertilizers :	120:40:40 kg NPK/ha
Spacing :	60 cm x 60 cm

During December, the land was ploughed once with mould board plough and harrowed twice. The treatments were allotted to the experimental plots by using random table. Shoot tip cuttings of 15-20 cm long with 4-5 nodes together with terminal bud crown of leaves were selected from healthy field grown plants. The cuttings were given a prophylactic treatment of bavistin solution (0.02%). Later, cut ends of the cuttings were dipped in IBA (1500 ppm) solution for 30 seconds. The cuttings were planted in polythene bags containing rooting mixture (Sand: FYM - 3:1) for rooting and arranged in mist chamber. After 45 days rooted cuttings were shifted outside for hardening.

The hardened rooted cuttings were shifted to GKVK and transplanted to the experimental plots.

The plots were levelled. Ridges and furrows were opened at 60cm apart. Then the rooted cuttings were planted on one side of the ridge and irrigated immediately after planting. Farmyard manure at the rate of 10 kg/plot was applied one month before planting. FYM was spread uniform in each plot and mixed thoroughly with the soil. Nitrogen in the form of urea (46 % N), phosphorus in the form of single phosphate (16 % P<sub>2</sub>O<sub>5</sub>) and potassium in the form of muriate of potash (60 % K<sub>2</sub>O) were supplied at the rate of 120:40:40 kg per hectare. 1/4<sup>th</sup> of nitrogen and entire dose of phosphorus and potassium were applied as a basal dose. Remaining dose of nitrogen was applied in three equal splits after every harvest and between one and half months after harvest.

The crop was harvested when the leaves turned to light green colour from dark and when they started blooming, as the oil content is reported to be maximum during that time. Plants were cut at 15-18 cm from the apex to ensure good regeneration capacity, using secateur to avoid any shock damage to the plants. The first harvest was at flowering, which indicated the maturity of crop. The second harvest was done during August 2001 that is three months after the first harvest, which acted as a pruning process, which helped faster regeneration of new shoots.

### The following methods were employed:

- Clevenger apparatus (hydro distillation)
- Mini pilot scale distillation (steam distillation) unit.

Both these methods were employed to know the oil content and yield. About 100g of the fresh herbage of each accession was distilled in clevengers apparatus for all the four replications. The period of distillation was kept constant for 3<sup>1/2</sup> hours. The mini pilot scale steam distillation the herb and here also the period of distillation was kept constant for 3<sup>1/2</sup> hours.

The observations were recorded on plant height, plant spread, number of leaves per plant, stem diameter, internodal length, leaf length, leaf width, leaf waist, leaf size, leaf shape, leaf form, herbage yield per plant, per plot and per hectare, essential oil content, essential oil yield per plant, per plot and per hectare.

### Statistical analysis and interpretation of data:

The data growth and yield parameters were subjected to Fisher's method of analysis of variance as

outlined by Sundararaj *et al.* (1972). Wherever the 'F' test was significant for comparison of treatment means, critical difference (C.D.) values were calculated at 5 per cent probability level.

## RESULTS AND DISCUSSION

The data on growth parameters as influenced by different accessions of scented geranium at different periods of growth and harvest are presented in Table 1.

In the Table 1, at first and second harvest, the accession PG-12 and PG-8 recorded the maximum plant height (53.45 and 54.77 cm, respectively). The highest plant height recorded by PG-8 at second harvest might be due to the fact that it also recorded longer internodal length at second harvest.

The accession PG-1 registered the maximum plant spread at both first and second harvest (5711.40 and

6706.43 cm<sup>2</sup>, respectively). This could be due to the apparent differences among the accessions and this accession was more spreading than the others. These results could be due to the robust nature of these accessions and also due to the difference in their growth patterns.

The accession PG11 recorded the maximum stem diameter (12.35mm) at first harvest, which was at par with PG-10 (11.66 mm) whereas it was lowest in case of CIMAP (10.09 mm). at second harvest also, PG-11 recorded highest stem diameter (12.68 mm) which was at par with PG-12 (11.88 mm) while, CIMAP registered the lowest stem diameter (10.45 mm). these results might be due to the varietal differences among the accessions.

Similar results were obtained by Bhaskar (1995) in patchouli and in scented geranium (Bhaskar *et al.*, 1998).

The accession PG-10 (Table 2) recorded the highest yield per plant, per plot and per hectare (1.15 kg, 23 kg

**Table 1: Growth parameters at first and second harvest of geranium**

Sr. No.	Accessions	Plant height (cm)		Plant spread (cm)		Number of leaves		Stem diameter (mm)	
		At I harvest 4 MAP	At II harvest (7 MAP)	At I harvest 4 MAP	At II harvest (7MAP)	At I harvest 4 MAP	At II harvest (7MAP)	At I harvest 4 MAP	At II harvest (7 MAP)
1.	PG-1	51.30	52.60	5711.40	6706.43	325.83	422.75	11.21	11.38
2.	PG-8	51.15	54.77	5467.40	6122.18	347.55	420.23	10.92	11.20
3.	PG-10	44.65	51.83	5418.85	6296.85	327.33	408.05	11.66	11.55
4.	PG-11	49.43	50.77	5112.55	6013.77	388.75	464.73	12.35	12.68
5.	PG-12	53.45	51.83	5180.70	5964.60	424.33	469.20	11.46	11.88
6.	KB	49.00	53.27	4656.48	5609.77	369.80	424.25	10.71	11.00
7.	CIMAP	48.90	50.63	4640.86	5508.89	326.63	405.33	10.09	10.45
F-test		NS	NS	*	*	*	*	*	*
S.E. ±		1.869	1.284	239.257	165.236	11.318	7.441	0.277	0.258
C.D. (P=0.05)		--	--	710.896	490.961	33.629	22.108	0.824	0.767

MAP- Month after planting , NS=Non -significant , \* - Significant

**Table 2 : Herb yield of scented geranium at first and second harvest**

Sr. No.	Accessions	I harvest			II harvest		
		Per plant (kg)	Per plot (kg)	Per hectare (t)	Per plant (kg)	Per plot (kg)	Per hectare (t)
1.	PG-1	0.92	18.35	25.47	1.23	24.50	34.02
2.	PG-8	0.72	14.40	19.98	1.15	23.00	31.94
3.	PG-10	1.15	23.00	31.94	1.35	27.00	35.76
4.	PG-11	0.77	15.35	21.32	1.42	28.50	39.58
5.	PG-12	0.79	15.85	22.01	1.15	22.87	30.03
6.	KB	0.69	13.90	19.30	1.26	25.25	35.06
7.	CIMAP	0.80	16.00	22.22	1.03	20.50	28.46
F-test		*	*	*	NS	NS	NS
S.E.±		0.082	1.639	2.275	0.116	2.341	3.394
C.D. (P=0.05)		0.244	4.871	6.760	---	---	---

NS=Non -significant , \* - Significant

and 31.94 t, respectively). This might be due to the fact that, plant spread of this accession was highest (6296.85 cm<sup>2</sup>) at second harvest. Further, the differences in their yield potential and genetic makeup. Naragund and Divakar (1983) observed differences for herb yield among the 3 varieties; Algerian variety recorded a maximum of 5.27 kg per plant followed by Reunion (CIMAP) which recorded 4.36 kg per plant and Reunion (Kodaikanal) which registered 4.30 kg fresh herb per plant. Bhaskar *et al.* (1998) found that the accession IIHR-8 was found to give highest herbage yield (58.54 t/year) followed by IIHR-1 (55.33 t/year) and IIHR-2 (36.24 t/year). The results observed in this study are conformity with the above results obtained by the above authors.

The geranium accessions (Table 3) varied widely with respect to the essential oil content which could be due to the inherent differences among the accessions due to their genetic makeup. It is very clear from the

results that, the oil content varied among the accessions and within the accessions, it varied considerably depending on the harvest period and the distillation method employed.

Generally the oil content is higher in case of Clevenger (Hydro) distilled oils than the steam distilled ones (Tables 3). These results confirm the observation made by Kaul and Rao (1995). In their experiment also, hydro distillation gave higher oil content (0.18, 0.26 and 0.10 % for Bourban, Kelkar and Algerian types) than steam distillation (0.10, 0.16 and 0.03%) for those three types, respectively). Further in all the accessions, considerable differences were noticed for essential oil content at two harvest periods, which is largely attributed to the climatic factors and also the seasonal influence. The accession PG-8 registered maximum oil content at second harvest, whereas, at first harvest KB and PG-8 recorded the highest oil content (0.475% hydro distillation; 0.2% steam distillation). The results

**Table 3 : Essential oil content (%) of seven scented geranium accessions**

Sr. No.	Accessions	I harvest		II harvest	
		Clevenger apparatus	Stem distillation	Clevenger apparatus	Stem distillation
1.	PG-1	0.325	0.137	0.313	0.130
2.	PG-8	0.437	0.200	0.425	0.160
3.	PG-10	0.262	0.065	0.187	0.063
4.	PG-11	0.287	0.090	0.237	0.077
5.	PG-12	0.275	0.092	0.175	0.065
6.	KB	0.475	0.195	0.400	0.165
7.	CIMAP	0.437	0.185	0.387	0.163
F-test		*	*	*	*
S.E.±		0.018	0.005	0.0148	0.005
C.D. (P=0.05)		0.055	0.016	0.044	0.017

\* - Significant

**Table 4: Essential oil yield of seven scented geranium accessions**

Sr. No.	Accessions	I Harvest			II Harvest		
		Per plant (kg)	Per plot (kg)	Per hectare (t)	Per plant (kg)	Per plot (kg)	Per hectare (t)
1.	PG-1	1.243	24.850	34.495	1.597	31.950	44.367
2.	PG-8	1.447	28.980	40.215	1.830	36.700	50.967
3.	PG-10	0.753	15.025	20.867	0.840	17.825	22.083
4.	PG-11	0.690	13.815	19.185	1.090	21.800	30.280
5.	PG-12	0.730	14.605	20.280	0.735	14.663	19.147
6.	KB	1.350	27.040	35.050	2.073	41.425	57.532
7.	CIMAP	1.480	29.550	41.037	1.663	33.225	46.140
F-test		*	*	*	*	*	*
S.E. ±		0.122	2.449	3.699	0.123	2.376	3.335
C.D. (P=0.05)		0.364	7.276	0.364	0.364	7.060	9.909

\* - Significant

obtained by Bhaskar *et al.* (1998) revealed that IIHR-8 recorded the maximum oil content than IIHR-1 and IIHR-2 at second harvest periods and the accessions varied, which confirms the present results. Similarly Pareek and Maheshwari (1990) and Patra *et al.* (2000) observed similar trends in oil content in case of palmarosa and vetiver, respectively. Studies at Kodaikanal on seasonal influence on content and quality of oil have shown that, harvesting four times at 90 days interval during January, April, July and October gave better oil recovery and quality (Mani and Sampath, 1981).

The accessions CIMAP and PG-8 recorded highest essential oil yield per plant, per plot and per hectare at first harvest; whereas KB and PG-8 recorded maximum oil yield per plant, per plot and per hectare at second harvest. These results are due to the fact that the accessions KB and PG-8 recorded highest oil content, which ultimately reflected in higher oil yields (Table 4). Whereas, PG-11 and PG-12 recorded the minimum oil yield at first and second harvest, respectively. This could be due to their lower oil content. In one of the experiments, Bhaskar *et al.* (1998) found that the genotype IIHR-8 possessed maximum oil content and IIHR-2 the least oil content, which leads to lower oil yield in the accession IIHR-2 confirming the present results that the essential oil yields varied largely due to the differences among the accessions especially for oil content and herbage yield. Ram *et al.* (1995) in geranium and Patra *et al.* (2000) in citronella have obtained similar kind of results for essential oil yield among the various varieties.

### Conclusion:

All the accessions showed difference in their growth and yield parameters. However, KB and PG-8 were found best among all for their essential oil yield and quality.

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