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Short communication

Heritability estimates of citral content in East Indian lemongrass

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Summary. Citral content in oil obtained from 80 representative clones, chosen randomly from a population raised from open-pollinated seeds of clonally propagated East Indian lemongrass variety 'SD-68' and their half-sib progenies was estimated by gas chromatography. Heritability estimates were determined by variance component and parent-offspring regression analyses. Broad-sense heritability was 0.49 while narrow sense heritabilities by variance and regression analyses were 0.37 and 0.24, respectively. Phenotypic and genotypic correlations between citral content in oil and oil content were very low both among the parental clones (–0.01 and –0.01, respectively) and among their progenies (0.13 and 0.08, respectively) indicating that selection for either of these traits would not have much effect on the other.

Key words: Aromatic grass – *Cymbopogon* – Citral content

Introduction

Lemongrass oil obtained from steam distillation of leaves of lemongrass (*Cymbopogon flexuosus* (Steud.) Wats), is one of the important aromatic oils used by the perfumery and cosmetics industry.

Lemongrass oil derives its economic importance from citral, the major constituent of lemongrass oil. Citral forms the precursor for the synthesis of ionones. Alpha-ionones are used in flavours, cosmetics and perfumes while beta-ionone is used in the synthesis of vitamin A. Lemongrass is grown in India, China, the West Indies and in Latin American countries. However, in spite of the highly commercial and industrial uses of lemongrass oil, very little work has been done on the genetics of lemongrass. Heritability estimates of four traits viz., leaf yield, tiller number, leaf width and oil content were reported recently (Kulkarni and Rajagopal 1986).

Heritability estimates of citral content, the most important constituent of lemongrass oil, are reported in this communication.

Material and methods

In August 1983, ramets (Harper 1977) of 80 plants, representing a random sample of a lemongrass population raised from open-pollinated seeds of clonally propagated variety 'SD 68' (Kulkarni and Rajagopal 1986), and their half-sib (open-pollinated) progenies, were transplanted in the field in two replications. Each family plot consisted of three parental ramets and four progeny plants. In October 1985, the parental clones and their progeny were evaluated for citral content (the plants were evaluated for other characters during the earlier harvests). Representative leaf samples of 200 g each, of parental plants and their respective progeny were distilled in Clevenger's apparatus (Langenau 1948). Only two distillations, one for the parental plants and the other for the progeny plants, were carried out for each family plot. The oil samples thus obtained were analysed by gas chromatography to estimate citral content in oil.

The data were subjected to analysis of variance. Heritability estimates were calculated by methods reviewed by Nguyen and Sleper (1983). Phenotypic and genotypic correlations between citral content and oil content were calculated by subjecting the data to analysis of covariance.

Results and discussion

There were significant differences for citral content both among parental clones and their half-sib progenies (Table 1). The values of mean and range for citral content of parental clones were similar to those of the progeny plants. Broad-sense heritability estimates

Table 1. Mean, range and heritability values of citral content (%) and phenotypic and genotypic correlation co-efficients between citral content and oil content in East Indian lemongrass

Parameter	Parents	Progeny
Mean ± SE	85.3** ± 1.9	80.2* ± 2.0
Range	79.1 – 90.5	73.6 – 86.9
h^2 (PFM)	0.49	0.37
h (bpo)	–	0.24
Correlation with oil content		
r_p	−0.01	0.13
r_g	−0.01	0.08

*,** Indicate that mean squares for genotypes were significant at $P=0.05$ and 0.01, respectively
SE = Standard error
h^2 (PFM) = Heritability on a phenotypic mean basis
h^2 (bpo) = Heritability obtained by parent-offspring regression method
r_p, r_g = Phenotypic and genotypic correlation coefficients, respectively

of citral content was moderately high. Narrow-sense heritability estimates obtained by variance and regression analyses suggested that half to more than half of the genetic variance was accounted by additive genetic variance. Expected gain from half-sib family selection using isolated polycross block for recombination of selected families was 2.1%, at a selection intensity of 10%.

Phenotypic and genotypic correlations between oil content and citral content were very low both among parental clones and their progeny (Table 1) suggesting that selection for either of the traits should not affect the other. The results of an earlier study on selection for oil content in lemongrass indicated that rapid improvement in oil content could be obtained without adversely affecting citral content in oil (Kulkarni et al. 1986). The results of the present study suggest that simultaneous selection of oil content and citral content should be possible. As lemongrass is commercially propagated through ramets, the objective of population improvement programme in lemongrass, from a practical point of view, would be to isolate superior plants combining high oil content and high citral content rather than to obtain an improved population for these two traits. Therefore, it is possible that the actual improvement through selection of superior individual plants after each cycle of recurrent selection may be more than the predicted gain for population improvement.

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References

Harper JL (1977) Population biology of plants. Academic Press, New York

Kulkarni RN, Rajagopal K (1986) Broad and narrow sense heritability estimates of leaf yield, leaf width, tiller number and oil content in East Indian lemongrass. Z Pflanzenzücht 96:135–139

Kulkarni RN, Rajagopal K, Ramesh S (1986) Selection for oil content in East Indian lemongrass. Plant Breeding 97: 78–81

Langenau EE (1948) The examination and analysis of essential oils, synthetics and isolates. In: Guenther E (ed) The essential oils. Von Nostrand, Princeton NJ, pp 227–367

Nguyen HT, Sleper DA (1983) Theory and application of half-sib matings in forage grass breeding. Theor Appl Genet 64:187–196