Madras Agric. J., 93 (7-12) : 279-282 July-December 2006

https://doi.org/10.29321/MAJ.10.100769

Research Notes

Variation and Correlation Studies in *Aloe vera* L. Ecotypes

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Aloe vera Linn. (2n = 14) is a succulent belongs to the family Liliaceae. Its leaves contain a very small quantity of viscous yellow fluid known as Aloe latex, which is embedded in the pericyclic cells of the vascular bundles. The dried latex otherwise known as Aloin is primarily used as a laxative or cathartic agent in Indian System of Medicines. The leaf gel or polysaccharides have been known to possess important biological properties such as anti-inflammatory, antibacterial, antitumour, antiallergic, infected wound healing by immuno enhancement and general tonic. The current global turnover of raw *Aloe* leaves amount upto US $70-80 million, which is expected to grow at a rate of 35 per cent in the next five years. The area under *Aloe vera* cultivation worldwide is 23589 ha, of which various American countries alone possess 19,189 ha, Australia 4170 ha, Africa 300 ha and India possesses only negligible area under this crop (Yogeeswaran *et al.,* 2005). So far its commercial cultivation is not popular among the farming community because of lack of technical know-how on correct ecotype/strain of *Aloe vera* and its package of practices. Though there is much diversity in *Aloe ve*ra, farmers find it very difficult to choose the best ecotype for commercial cultivation. Hence, an investigation was carried out to assess the range of variability exists among different *Aloe vera* ecotypes and to correlate the different growth parameters with yield and quality.

The experiment was conducted during 2005-06 at the Faculty of Agriculture, Gandhigram Rural University, TamilNadu. Twenty one *Aloe vera* ecotypes were collected from the wild state and from research institutions across south India. The experiment was laid out in Randomized Block Design. Analysis of variance was carried out as suggested by Panse and Sukhatme (1985). Flat beds of 2.25 x 2.4 m were prepared and the Aloe suckers of 15-18 cm long were planted at a spacing of 75x60cm accommodating 12 plants bed^{-1}. Growth characters such as plant height, plant spread, number of suckers plant^{-1}, growth rate in terms of height gain month^{-1}, growth rate in terms of number of leaves produced month^{-1}, number of leaves plant^{-1}, leaf length, leaf width, leaf thickness and leaf volume were recorded at first harvest done at 240 DAP. Leaf volume was calculated using the formula V= (L/12) 3.14WT (Hernandez-Cruz, 2002) where, L, W and T are leaf length, width and thickness respectively. It was the longest leaf just fully grown, appears nearly at the centre of the plant spread. The edge of the leaf base is parallel at this stage (Ray, 1999). The 'D' leaves from randomly selected plants were harvested and observations like leaf weight, gel yield, gel acidity, total and soluble solids were estimated. Gel: peel ratio was arrived by dividing gel weight by peel weight. Aloe latex was collected by giving a transverse cut 2cm above the base of leaves and allowing for half-an-hour for the latex to drain from the leaves. The gel quality parameters such as gel pH, total and soluble

Table. 1. Range of variation in growth, yield and quality characters of twenty one *Aloe vera* ecotypes

Characters	Minimum	Ecotype	Maximum	Ecotype	Average
Plant height (cm)	46.40	ZMR	79.31	TCY	62.86
Plant spread (cm)	32.76	KH	85.38	TCY	59.07
No. of suckers plant^{-1}	4.88	ZMR	11.38	IIHR AV-15	8.13
Growth rate – height gain month^{-1} (cm)	3.99	ZMR	8.64	TCY	6.32
Growth rate – No. of leaves produced month^{-1}	1.07	IIHR AV-4	3.94	TCY	2.51
No. of leaves plant^{-1}	10.88	IIHR AV-4	29.50	TCY	20.19
Leaf length (cm)	40.89	ZMR	63.10	TCY	52.00
Leaf width (cm)	4.40	IIHR AV-15	10.92	TCY	7.66
Leaf thickness (cm)	1.53	KRR	2.74	TVM	2.14
Leaf volume (cm^3)	104.43	IIHR AV-15	429.27	TVM	266.85
Leaf weight (g leaf^{-1})	187.76	IIHR AV-15	434.30	TCY	311.03
Leaf yield (g plant^{-1})	352.36	IIHR AV-15	1597.37	TVM	974.87
Gel yield (g leaf^{-1})	112.63	IIHR AV-15	282.57	TVM	197.60
Gel : Peel ratio	0.88	TCY	2.37	GGM	1.63
Wet latex yield (g leaf^{-1})	0.19	IIHR AV-15	0.40	TCY	0.59
Dry latex yield (g leaf^{-1})	0.11	IIHR AV-15	0.32	TCY	0.22
Gel acidity (pH)	3.93	TVM	4.49	IIHR AV-15	4.21
Total solids in gel (%)	0.62	KH	0.81	TVM & TCY	0.72
Soluble solids in gel (%)	0.52	KH	0.71	TVM	0.62

solid content were also estimated by adopting standard procedures.

Variation studies

Considerable variation in terms of growth, yield and quality parameters was noted from the 21 ecotypes tested (Table.1). An ecotype TCY showed maximum values for plant height (79.31cm), plant spread in North-South direction (85.38cm), growth rate in terms of height gain month^{-1} (8.64cm), growth rate in terms of number of leaves produced month^{-1} (3.94), number of leaves plant^{-1} (29.50), leaf length (63.10cm), leaf width (10.92cm), leaf weight (434.30g) and aloin yield leaf^{-1} (0.32g). Ecotype named TVM recorded the maximum values for the traits such as leaf thickness (2.74cm), leaf volume (429.27 cm^3), leaf yield plant^{-1} (1597.37g), gel yield leaf^{-1} (282.57g), total solids (0.81 %) and soluble solids in gel (0.71%). Though the ecotype TCY recorded the maximum values for growth characters, ecotype TVM showed its superiority in yield and quality parameters. This is in consonance with the earlier findings in evaluation of 44 genetic stocks of *Aloe vera* collected from Rajasthan and elsewhere in India (Singh, 1995). Variation in mean performance of different ecotypes will be helpful for the elimination of undesirable ecotypes and consideration of desirable ecotypes for further crop improvement programme.

Correlation studies

The knowledge of correlation helps in determining the relative importance of the

Table.2. Simple correlation coefficients among growth characters with leaf yield plant^{-1} (g), gel yield plant^{-1} (g) and aloin yield plant^{-1} (g) in *Aloe vera* ecotypes

	Character	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	Y_1	Y_2	Y_3
X_1	Plant height (cm)	1.000	0.778**	0.154^{NS}	0.891**	0.783**	0.705**	0.382^{NS}	0.797**	0.530*	0.702**	0.595**	0.777**
X_2	Plant spread (cm)		1.000	0.077^{NS}	0.668**	0.781**	0.636**	0.357^{NS}	0.734**	0.630**	0.716**	0.669**	0.748**
X_3	No.of suckers			1.000	0.031^{NS}	0.004^{NS}	-0.267^{NS}	0.469*	0.068^{NS}	-0.362^{NS}	-0.037^{NS}	0.070^{NS}	-0.204^{NS}
X_4	No.of leaves				1.000	0.769**	0.802**	0.339^{NS}	0.830**	0.570**	0.729**	0.606**	0.726**
X_5	Leaf length (cm)					1.000	0.778**	0.398^{NS}	0.857**	0.578**	0.677**	0.646**	0.748**
X_6	Leaf width (cm)						1.000	0.349^{NS}	0.909**	0.754**	0.765**	0.636**	0.669**
X_7	Leaf thickness (cm)							1.000	0.613**	0.209^{NS}	0.554**	0.616**	0.246^{NS}
X_8	Leaf volume (cm^3)								1.000	0.641**	0.819**	0.753**	0.644**
X_9	Leaf weight (g)									1.000	0.877**	0.804**	0.638**
Y_1	Leaf yield plant^{-1} (g)										1.000	0.95 **	0.68 **
Y_2	Gel yield plant^{-1} (g)											1.000	0.58 **
Y_3	Aloin yield plant^{-1} (g)												1.000

*, ** significant at 5 and 1 per cent respectively

component characters influencing the yield. The practice of selection of ideal ecotype based on individual traits may not always be of rewarding. So character association studies are of great significance.

Leaf yield plant^{-1}, gel yield plant^{-1} and aloin yield plant^{-1} are correlated among each other. All growth characters had significant and positive association with leaf yield plant^{-1} and gel yield plant^{-1} except number of suckers. With regard to association with aloin yield plant^{-1} all characters except number of suckers and leaf thickness showed significant and positive association. Number of suckers showed no association with leaf yield plant^{-1}, gel yield plant^{-1} and aloin yield plant^{-1}.

Considering the inter correlation among growth characters, plant height, plant spread, number of leaves, leaf length, leaf width, leaf volume, leaf weight has significant and positive correlation among themselves. Number of suckers had significant and positive association with leaf thickness alone. Leaf thickness showed significant and positive association with leaf volume only.

From the foregoing study, considerable variation was observed for different growth, yield and quality parameters among the 21 ecotypes. Ecotype TVM (Tiruvannamalai) showed its superiority for gel yield and quality and TCY (Trichy) for aloin yield. The correlation study showed that characters namely, plant height, plant spread, number of leaves, leaf length, leaf width, leaf volume and leaf weight can be considered as selection indices for *Aloe vera* crop improvement programme.

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Madras Agric. J., 93 (7-12) : 282-287 July-December 2006

Growth, Yield, N uptake of Turmeric (*Curcuma longa* L.) in Alfisol as affected by lignite humic acid.

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The importance of soil organic matter both as a direct or indirect source of plant nutrient elements has been very well stressed and highlighted. In plant nutrition, organic matter level plays a significant role in deciding the availability status of essential nutrients. Considering the importance of soil humus in stimulating the plant growth and influencing the soil physical environment, it has become necessary to apply humus matter extracted from coal, peat and lignite apart from other organics (FYM, composted coir pith, sludge, *etc.)* to soil in order to sustain the soil fertility and productivity. Several scientists tested the usability of lignite which contains high content of humic acid substances (Stevenson, 1994 and Schnitzer, 2000). Narayanan (1989) revealed that the Neyveli lignite with the very low ash content was the best suited for production of humic acids.

Turmeric being a long duration crop, it removes greater amount of nutrients both from the soil and as well as the applied fertilizers. For a healthy crop of turmeric, 20-25 t ha^{-1} of organic manure is needed.