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RESEARCH ARTICLE

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Identification of promising agave genotypes for marginal and sub-marginal lands

S.B. DEVARANAVADGI, S.B. PATIL, S.R. MULLA AND M.B. JAMBAGI

ABSTRACT

A field experiment was carried out at Regional Agricultural Research Station, Bijapur, Karnataka during 1999 to 2009 to know the performance of eight genotypes of agave under marginal and sub-marginal lands. Observation like morphological characters (*viz.*, plant height, number of leaves, leaf length and lead breadth), yield characters and fibre quality were recorded from agave plantations. Of the eight species studies, BAS-1 recorded higher leaf number per clump (43), leaf length, leaf breadth, number. of leaves, plant height, leaf yield, breaking load, breaking extension and tenacity. Economics also proved that BAS-1 (B:C ratio 4.41) was highly profitable for marginal and sub-marginal lands.

KEY WORDS : Agave, Economics, Marginal lands, Tenacity

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INTRODUCTION

Vast stretches of lands in rainfed areas have been subjected to severe soil erosion exposing the parent material or making these soils highly improvise where northing worth could be grown. These land are most suited for alternate land use system, species yielding fibre are preferred. An example of fibre yielding species is the agave.

Agave (Family : Amaryllidaceae) is short stemmed plant, bearing a rosette of long erect point fleshy leaves noted for their pale white to golden yellow fibre content. It is highly drought resistant species, suited for harsh areas and could come up with practical no or little care (Suresh *et al.,* 1992).

The success of Indian farming is very much dependent on the behaviours of the monsoon. Under such conditions the resource poor Indian farmer needs to innovate to make a meaningful living. Such innovations would be planting of agave (sisal) on field bunds, across gullies and as live bunds for soil and water conservation. About 7000ha of waste land is under sisal in Orissa (Thaingarajan, 1986) which is the leading state followed by Bihar, Maharastra and West Bengal.

Agave fibre is strong coarse, flexible and used for making ropes, twine, fishing nets, door mats etc. and the short fibres are used for making rope and brushes (Anonymous, 1984). The material left after decorticating the leaves is used in craft paper and paper board making. Srinivasalu Rao *et al.* (1983) reported the process of the extraction of Hecogenin a steroid for production of corticosteroids from sisal juice. Thus knowing the multivarious utility of this plant species it becomes imperative for us to organize a core of plantations of this plant species. Now choice of species plays a vital role in the productivity and economy of the entrepreneur. To assess the potentiality of the species, locally cultivated *Agave* species have been evaluated for their morphological and yield characters including the fibre quality.

Correspondence to:
S.B. DEVARANAVADGI, University of Agricultural Sciences (D), Regional Agricultural Research Station, BIJAPUR (KARNATAKA) INDIA
Email : dnavadgi@rediffmail.com

Authors' affiliations:
S.B. PATIL, S.R. MULLA AND M.B. JAMBAGI, University of Agricultural Sciences (D), Regional Agricultural Research Station, BIJAPUR (KARNATAKA) INDIA
Email : rars_bijapur@rediffmail.com

MATERIALS AND METHODS

The experiment was carried out at Regional Agricultural Research Station, Bijapur during 1999 to 2009 under randomized block design with three replications. The agave genotypes were planted in a field during July 1999 with a spacing of 2 x 1 m.

Treatment details:

– BAS-1 : *Agave americana* (Burma)

- BAS-2 : *Agave americana* (Hanumatti)
- BAS-3 : *Agave amaniensis*
- BAS-4 : *Agave angustifolia*
- BAS-5 : *Agave cantala*
- BAS-6 : *Agave sisalana*
- BAS-7 : *Agave sisalana* (Local)
- BAS-8 : Selection GDR (Golgumaz)

The study area is located at latitude 16^0 49' North, longitude 75^0 43' East at an altitude of 593.6m above mean sea level with mean annual rainfall of 586 mm. Soil of study area was shallow black in nature, these soils were low in nitrogen and phosphorus and medium in available potassium. Depth of the soils was less than 30cm; the infiltration rate was moderate to high (2 to 3 cm/h).

Morphological characters:

Morphometric attributes like plant height, number of leaves, leaf length and leaf breadth were recorded from each clump and their mean value was taken for statistical analysis and interpretation of data was made as per the procedure given by Gomez and Gomez (1984).

Yield characters:

All the leaves in each sample were weighed in the field itself using a spring balance within a reasonable short time. Fibre was extracted using mechanical decorticator, washed in fresh water and sun dried. After drying for 6 hours each sample was weighed and the weight was recorded. Economics of agave cultivation per hectare was worked out.

Fibre quality:

The length of the fibre was recorded using the meter scale and the thickness was recorded by Verneir Caliper.

Tensile properties:

Gauge length: (2.5cm), cross head speed (5mm/min.), the breaking load (g), breaking extension (%), breaking energy (kgf-mm), tex and tenacity (g/tex) were recorded and tabulated.

RESULTS AND DISCUSSION

Out of the eight agave genotypes, BAS-1 was found to have superior morphological characters like plant height (cm), number of leaves, leaf breadth which leads to higher fresh weight of agave (Table 1).

Regarding the tensile properties of fibres, out of eight genotypes breaking load (994 g) of BAS-1 was higher than the remaining genotypes. Similarly breaking extension

Table 1 : Morphological characters of the agave genotypes

Sr. No.	Treatments	Plant height (cm)	No. of leaves	Leaf length (cm)	Leaf breadth (cm)
1.	BAS-1	71.00	43.07	49.36	5.45
2.	BAS-2	69.93	24.07	51.60	5.81
3.	BAS-3	75.13	23.93	59.87	6.20
4.	BAS-4	35.20	29.87	19.48	2.79
5.	BAS-5	89.13	30.00	69.56	4.97
6.	BAS-6	73.07	26.00	50.59	6.08
7.	BAS-7	85.27	28.33	68.23	5.23
8.	BAS-8	31.90	28.77	17.80	8.88
	S.E. ±	6.51	2.70	4.70	2.34
	C.D. (P=0.05)	19.73	8.18	14.26	NS

Table 2 : Tensile properties of agave fibres

Sr. No.	Treatments	Breaking load (g.)	Breaking extension (%)	Breaking energy (kgf-mm)	Tex	Tenacity (g/tex)
1.	BAS-1	994	6.95	0.895	18.8	52.9
2.	BAS-2	961	5.14	0.904	21.1	45.3
3.	BAS-3	548	5.93	0.458	12.4	44.2
4.	BAS-4	328	5.14	0.248	6.8	48.2
5.	BAS-5	449	4.06	0.257	13.6	33.0
6.	BAS-6	725	5.66	0.601	18.4	39.4
7.	BAS-7	306	4.14	0.157	9.2	33.3
8.	BAS-8	260	5.67	0.241	6.8	38.2

(6.95%), tenacity (52.9 g/tex) were higher in BAS-1 genotype where as other fibre tensile properties like tex and breaking energy of BAS-1 were at par with BAS-2 (Table 2).

Among quality parameters of agave genotypes (Table 3), the fibre length was highest in cane of BAS-1 (7.8 mm) followed by BAS-2 (6.9 mm) and the lowest fibre length was recorded in case of BAS-8. The pulp yield of BAS-1 (35.1%) was highest with kappa number of 31.4. The lowest pulp yield was noticed in case of BAS-4. However, the quality parameters indicated that, BAS-1 was superior than the others.

With regard to fibre recovery, BAS-1 recorded the highest yield of agave in all the respective years. The average yield of agave over the years (6 years), the highest yield was recorded by BAS-1 (17.04 t/ha) followed by BAS-5 and 2 (Table 4 and Fig. 1).

The economics of agave cultivation was worked out

Table 3 : Quality parameters of the promising agave genotypes

Sr. No.	Treatments	Pulp yield on OD chips (%)	Kappa No.	Fibre length (mm)
1.	BAS-1	35.1	31.4	7.8
2.	BAS-2	29.3	23.9	6.9
3.	BAS-3	27.3	22.2	6.6
4.	BAS-4	21.7	42.6	6.2
5.	BAS-5	30.2	24.3	5.8
6.	BAS-6	27.2	29.1	6.7
7.	BAS-7	32.2	28.8	5.9
8.	BAS-8	28.5	49.3	5.4

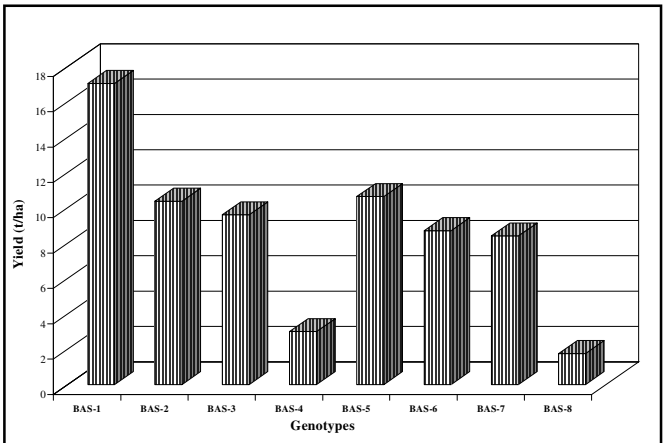

Fig. 1 : Yield (t/ha) of promising Agave genotypes over a period of time

Table 4 : Yield (t/ha) of promising agave genotypes over a period of time

Sr. No.	Treatments	Years						Av. yield (t/ha)
		2004	2005	2006	2007	2008	2009	
1.	BAS-1	12.38	18.08	19.75	16.71	17.17	18.18	17.04
2.	BAS-2	7.56	9.19	11.44	10.25	11.71	12.13	10.38
3.	BAS-3	6.23	8.33	8.17	8.25	13.25	13.41	9.61
4.	BAS-4	2.79	3.50	2.77	1.96	3.29	3.71	3.00
5.	BAS-5	6.79	9.69	9.42	10.29	12.58	15.04	10.64
6.	BAS-6	6.42	6.85	9.21	7.21	11.08	11.50	8.71
7.	BAS-7	4.31	6.79	6.52	6.69	12.42	13.79	8.42
8.	BAS-8	1.81	2.04	1.50	1.29	1.71	2.20	1.76
	S.E. ±	1.81	2.79	1.38	0.24	1.93	1.40	--
	C.D. (P=0.05)	5.48	8.46	4.18	0.73	5.86	4.20	--

Table 5 : Economics analysis of promising agave genotypes

Sr. No.	Treatments	Av. yield of 6 years (t/ha)	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B : C ration
1.	BAS-1	17.04	17037	3150	13887	4.41
2.	BAS-2	10.38	10380	3150	7230	2.30
3.	BAS-3	9.61	9607	3150	6457	2.05
4.	BAS-4	3.00	3003	3150	-147	-0.05
5.	BAS-5	10.64	10635	3150	7485	2.38
6.	BAS-6	8.71	8712	3150	5562	1.77
7.	BAS-7	8.42	8420	3150	5270	1.67
8.	BAS-8	1.76	1758	3150	-1392	-0.44

which proved that cultivation of BAS-1 genotype was more profitable (B:C ratio 4.41) compared to other genotypes.

Finally, the study has proved that cultivation of agave in dry and waste lands will increase the returns, improve the living condition of dryland farmer, reduce soil runoff and increase the moisture percentage. Beside, it could also provide the way for establishment of cottage industries and the employment opportunity.

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