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SPLITTING OF BULBILS FOR MULTIPLICATION OF *AGAVE SISALANA*

P. S. Takawale*, P. K. Kulkarni & N. G. Hegde

BAIF Development Research Foundation, Central Research Station, Urulikanchan, District Pune - 412 202, India

Agave sisalana is indigenous to tropical and subtropical America and is distributed from South America northwards to Mexico. It was introduced in India for ornamental and soil conservation purposes. Agave thrives best under high temperatures and is one of the most suitable hardy plants that can profitably be raised on denuded wastelands where nothing else can be grown (Gupta *et al.* 1989). Agave has a tufted, spreading, fibrous root system and no tap root. Its foliage occurs in whorls, and provide full cover to the soil below. Close planting (100 × 50 cm) of this species prevents direct fall of raindrop on the ground, and, thereby, runoff. Farmers grow this species at close spacing in rows around fields and wasteland boundaries as live fence to prevent stray cattle grazing the land. Agave is also resistant to saline water and is one of the strongest fibres, always being in demand in mercantile industry, and have many other commercial uses (Anonymous 1985).

Agave can only be propagated vegetatively by means of suckers or bulbils. Agave produces rhizomes from buds at the base of the plant which is situated below ground level. Rhizomes extend horizontally, mostly at depths of 5 to 15 cm in the soil, before growing upwards to give rise to suckers at the surface. Suckers strike root after being detached from the parent tree and replanted. Suckers are frequently used as planting material.

The production of bulbils by agave is a form of vegetative production. Bulbils arise from tiny buds and are protected by conspicuous papery bracts, or bracteoles, which are found on each flower stalk a few millimeters below the line of abscission. Each bulbil is a plantlet and has six to eight reduced leaves, plus a rudimentary root system already developed from the base of the first leaves. Bulbils may appear on the bottom branches of a pole before flowering is over, and they take about two or three months to grow to a size of 6 to 10 cm, depending upon the weather. When mature, they either fall off, or may be easily shaken off the pole. Agave is a perennial monocrop because it only flowers once during a life of several years after which it dies. A plant produces only eight to 20 suckers and 250 to 1800 bulbils in its lifetime. It is clear that the production of suckers and bulbils is inadequate to meet the requirement for planting material. Hence an attempt was made to develop a mass multiplication method of *A. sisalana* using bulbil sections.

The research was carried out at the Central Research Station of BAIF Development Research Foundation, Urulikanchan, Pune (18.5° N latitude 73.8° E longitude and at an altitude of 559 m asl). Fresh bulbils of *A. sisalana* were collected from mother plants and cut vertically into half, one fourth or single basal leaf with sheath. These three types of bulbil sections and full bulbils were used as planting material. The bulbil sections were dipped into 0.1% bavastin for two to three minutes. After washing, they were treated

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**E-mail: crs@pn2.vsnl.net.in*

with indole butyric acid (IBA) powder by smearing the basal portion. The IBA concentrations used were 1250, 2500 and 5000 ppm.

The treated bulbil sections were planted in polythene bags (10 × 18 cm) filled with a mixture of sand, soil and compost (1:1:1). The bags were placed in a shadenet house in March. Each treatment was replicated three times in a randomised block design. The rooting response was examined 45 days after planting.

The data on rooting behaviour of different treatments is presented in Table 1. Table 2 shows the analysis of variance of rooting behaviour. The results revealed statistically significant differences between treatments. The percentage of rooting in various splits ranged from 98.33% in entire bulbil to 54.44% in single leaf (Figure 1). Growing 100 entire bulbils resulted in producing 98 propagules (results not shown). The splitting of 100 bulbils each into two produced 194 propagules while splitting into four produced 344 propagules. This means despite a lower rooting percentage, bulbils split into four yielded more propagules compared with bulbils split into two and single leaf section. Cutting the large bulbs into small sections having root pads has been recommended for mass multiplication of Red Squill (*Urginea maritima*) (Gentry *et al.* 1987).

Table 1 Effect on rooting behaviour of bulbil splits in *Agave sisalana*

	Control	IBA 1250	IBA 2500	IBA 5000	Mean
Rooting percentage					
Entire	100.00 ± 0.00	93.33 ± 6.67	100.00 ± 0.00	100.00 ± 0.00	98.33 ± 1.66
1/2 cut	93.33 ± 6.67	93.33 ± 6.67	100.00 ± 0.00	100.00 ± 0.00	96.66 ± 2.24
1/4 cut	73.33 ± 17.65	93.33 ± 6.67	100.00 ± 0.00	77.78 ± 2.26	86.11 ± 5.22
Single leaf	53.33 ± 17.65	53.33 ± 13.39	66.67 ± 13.39	44.44 ± 8.02	54.44 ± 6.24
Mean	79.99 ± 7.79	83.33 ± 6.44	91.66 ± 5.20	80.55 ± 7.08	
Root number					
Entire	3.89 ± 0.29	7.22 ± 0.98	4.22 ± 0.77	3.67 ± 0.57	4.75 ± 0.52
1/2 cut	2.78 ± 0.61	4.33 ± 0.88	3.67 ± 0.19	2.22 ± 0.55	3.25 ± 0.35
1/4 cut	1.79 ± 0.21	2.39 ± 0.14	1.89 ± 0.22	2.68 ± 0.16	2.19 ± 0.13
Single leaf	1.25 ± 0.25	1.70 ± 0.12	2.02 ± 0.02	2.15 ± 0.17	1.78 ± 0.12
Mean	2.43 ± 0.34	3.91 ± 0.70	2.95 ± 0.35	2.68 ± 0.35	
Root length					
Entire	7.60 ± 1.16	7.09 ± 0.57	7.70 ± 0.97	6.21 ± 0.50	7.15 ± 0.40
1/2 cut	9.03 ± 2.17	7.19 ± 1.37	7.42 ± 0.84	8.53 ± 1.56	8.04 ± 0.70
1/4 cut	7.05 ± 0.46	5.01 ± 0.32	6.08 ± 1.02	6.15 ± 0.44	6.07 ± 0.34
Single leaf	5.88 ± 0.27	11.01 ± 1.23	6.55 ± 0.83	6.96 ± 0.82	7.60 ± 0.70
Mean	7.39 ± 0.63	7.56 ± 0.77	6.94 ± 0.44	6.96 ± 0.49	

Table 2 Analysis of variance of rooting percentage, root number and root length in *Agave sisalana*

Source	df	Rooting % MS	Root number MS	Root length MS
Replication	2	914.84*	1.32	4.92
Bulbil split	3	4975.36**	21.06**	8.56
Rooting hormone	3	348.16	5.04**	1.20
Error	39	176.83	1.03	3.98

* $p < 0.05$
** $p < 0.01$
MS = mean sum square

Figure 1 Rooting and sprouting in bulbil splits of *Agave sisalana*

A - Entire bulbil
B - Half cut bulbil
C - One fourth cut bulbil
D - Single basal leaf

Generally the application of IBA 2500 ppm produced higher rooting percentage (91.66%) compared with concentrations of 1250 and 5000 ppm (83.33 and 80.55% respectively). This effect was more pronounced when bulbils were split into four; rooting percentage improved from 73.33% in control to 100% in 2500 ppm IBA (Tables 1 and 2). Uppal and Khosla (1997) has also recorded significant effects of IBA on rooting percentage in selected temperate shrubs.

Root numbers significantly increased with the application of IBA 2500 ppm. However, in the case of root length, the effect of IBA application was not significant. We found that when rooted bulbils were planted, they established and grew well regardless of the root length.

From the above study it was concluded that splitting the bulbils into four and application of IBA 2500 ppm is recommended for obtaining large number of propagules in a short period of time. Further studies on the effects of different rooting hormones, either singly or in combination, and in various concentrations, are needed.

References

ANONYMOUS. 1985. *Wealth of India: Raw material.* Volume IA. Revised edition. Publication and Information Directorate, CSIR, New Delhi.

GENTRY, H. S., VERBISCAR, A. J. & BANIGAN, T. F. 1987. Red Squill (*Urginea maritima* Liliaceae). *Economic Botany* 41(2): 267–282

GUPTA, R. K., AGRAWAL, M. C. & JOSHIE, P. 1989. Economic evaluation of sisal with and without Bhabar on bouldery wastelands of Doon valley. *Indian Journal of Soil Conservation* 17(3): 39–44.

UPPAL, R. & KHOSLA, P. K. 1997. Vegetative propagation through branch cuttings in selected temperate shrubs of Western Himalayas. *Annals of Forestry* 5(1): 80–83.