



Effect of Organic Manures on Yield and Essential Oil of sweet Flag in Konkan Region

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ABSTRACT

Acorus calamus (Sweet flag) is one of the endangered medicinal plants mostly grown in wild without much attention. Also it is in high demand in pharmaceutical and perfumery industries. Hence, a study was undertaken of 2017-18 to assess the possibility of optimizing its rhizome yield and essential oil recovery by different source of organic manures based on recommended doses of nitrogen under field condition. Significantly maximum rhizome yield (4674.7 kg ha⁻¹) and essential oil recovery (1.87%) was obtained with Farm yard manure 100% of RDN. Hence this study illustrates the possibility of optimizing rhizome yield and essential oil content of *A. calamus* through organic manures only.

Key Words:

Acorus calamus, Rhizome, Yield, Essential oil, Organic manure

INTRODUCTION

Acorus calamus Linn. is a tall perennial wetland monocot plant from the Acoraceae family and commonly known as Sweet flag in English, *Vacha* in Sanskrit and *Vekhand* in Hindi and Marathi. Sweet flag is a semiaquatic perennial herb with a stout midrib, with creeping and many branched aromatic rhizomes. It consists of long creeping rhizomes which spread out just below the surface of the soil. The rhizomes are whitish pink internally, cylindrical in shape. Leaves are free, alternate, green and wavy having thin testa which is cylindrical in shape. (Prakash et al. 2015).

Acorus calamus is one of the endangered medicinal plant; mostly growing in wild form without much attention (Singh and Nongmaithem

2013) and found near swamps and banks of perennial wetlands in Asia, Europe, and North America. It is indigenous to the marshes of the mountains of India and found in Kashmir, Shirmaur (Himachal Pradesh), Manipur and Naga Hills (Shetty et al. 2015). It is cultivated throughout India, ascending to an altitude of about 2200 metres. It is regularly cultivated in the Koratagere taluka of Karnataka state in an area of 100 acres and the annual production is 400 tonnes of dried rhizomes (Lokesh 2004).

Demand for the crop material of sweet flag is a derived demand and that is based on Ayurvedic medicines. This has increased substantially during the recent years due increased dependence on Ayurvedic medicines. The dramatic increase in exports of medicinal plants in the past decade

upholds the worldwide demand for these products as well as in traditional health systems. (Deshpande et al 2006)

Medicinal plants are natural resources as they are unique, indispensable and an estimate of their availability is complex. These provide a good source of income if cultivated aggressively and traded, as the demand is fast increasing. According to National Medicinal Plant Board (NMPB), the annual demand of *Acorus* roots by the herbal industries and crude drug producers in all over India nearly 500-1000 metric tonnes. The current price of *Acorus* roots is Rs. 100 Kg⁻¹. *Acorus calamus* contains yellow aromatic volatile oils; β -asarone and α -asarone are the major constituent in the leaves (27.4 to 45.5%), whereas, acorenone is dominant in the rhizomes (20.86%) followed by isocalamendiol (12.75%). Monoterpene hydrocarbons, sequestrine ketones, (trans or alpha) asarone (2,4,5-trimethoxy-1-propenylbenzene), and β asarone (cis-isomer) and eugenol have also been identified. *A. calamus* is also a source of alkaloids, flavanoids, gums, lecithins mucilage, phenols, quinine, saponins, sugars, tannins and triterpenes, etc (Prakash et al. 2015).

Extracts of different parts and essential oil of *Acorus calamus* are widely used in pharmaceuticals, traditional systems of medicines for a number of ailments. The species are used in traditional medicine for the treatment of cough, epilepsy, mental ailments, chronic diarrhoea, dysentery, bronchial catarrh, skin diseases, intermittent fevers, and glandular and abdominal tumours (Paithankar et al. 2011). Different drug types with varying content of β -asarone were obtained from *Acorus calamus*. The plant extracts shows various biological activities including as anti-bacterial, anti-fungal, insecticidal, nematocida, antiulcer and cytoprotective activity, anti-inflammatory, anticonvulsant (Kumar and Vandana 2013).

For along crop duration (about 10 months) and its rhizomatous nature, it requires heavy input of

fertilizers. But, continuous use of inorganic chemical fertilizer negatively affects soil environment and pollutes underground water (Naguib 2011). It is essential to reduce indiscriminate use of inorganic chemical fertilizer and to simultaneously increase the use of organic manures which improve soil, plant health. Therefore, the present investigation was carried out to assess organic manures on rhizome yield and essential oil of Sweet flag in Konkan region.

MATERIAL AND METHODS

The study was conducted in the experimental farm of College of Forestry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, District Ratnagiri of Maharashtra during 2017-2018. The study area is located between 17° 45" N and 73° 12" E. The climate of Dapoli is warm and humid. During study period maximum and minimum temperature ranged from 19.3 to 31.4° C, respectively. The total rainfall received during the period of study was 3605.6 mm in 109 days. The relative humidity during the crop period ranged 71.52 to 93.54 per cent.

The experiment was laid out in Randomised Block Design. For these objectives, Vermicompost, Farm yard manure, Leaf litter, Neem cake were used. Total five treatments having three different source of Nitrogen such as 75%, 100% and 125% were given to plots. The treatment was replicated thrice. A total 42 numbers of rhizomes were planted at 30 cm x 30 cm spacing in every treatment (July 2017). The treatment plot size was 2.1 m x 1.8 m. For the rhizome yield, the plants were harvested after 270 days in the month of April 2018 from all the plots rhizomes were cleaned and taken the fresh weight. The essential oil was extracted and carried out by soxhlet's extraction method at temperature (100° C) at extraction time of 4-5 hrs.

RESULTS AND DISCUSSION

The results of experiment on the biomass yield and the essential oil content are presented in Tables 1. Data on rhizome yield, irrespective of organic manures was highest T₅ Farm yard

manure 100% of RDN (4674.7 kg ha⁻¹) when harvested after 270 days (Table 1) followed by T₄ Farm yard manure 75% of RDN (4632.7 kg ha⁻¹). The variation in yield of sweet flag as affected by different levels of application of organic manures and date of planting was also reported by Jarman (2009), Thakur and Agrawal (2009) and Tiwari et al (2012). The plant age had significant effect on total fresh yield and leaves and rhizomes fresh weights (Osman *et al.* 2008). Fresh and dry yield of sweet flag is significantly affected by FYM treatment (Lokesh 2004). FYM and GA3 are beneficial for increasing the rhizome yield of Sweet flag (Datta et al. 2012).

In the present investigations (Table 1) it has been observed that the various organic manures significantly affected the oil content in rhizome of *A. calamus*. Maximum oil content was recorded in T₅ (1.87%) followed by T₄ i.e. Farm yard manure 75% of RDN (1.85%). Essential oil recovery has been reported in the range of 1.1-3.3% for supercritical carbon dioxide extraction (SFE) and 1.0-2.4% in the case of simultaneous distillation and extraction (SDE) (Gretsusnikova *et al.*, 2009, Andola et al. 2012). Organic manures significantly effect the oil content of *A. calamus* (Lokesh 2004).

Table 1. Effect of organic manure on yield of rhizome per ha and oil content of Sweet flag (*Acorus calamus* Linn.)

	Treatment	Rhizome Yield (kg ha ⁻¹)	Oil content (%)
T ₁	Vermicompost 75% of RDN	2189.50	1.45
T ₂	Vermicompost 100% of RDN	2420.10	1.42
T ₃	Vermicompost 125% of RDN	2119.20	1.48
T ₄	Farm yard manure 75% of RDN	4632.70	1.85
T ₅	Farm yard manure 100% of RDN	4674.70	1.87
T ₆	Farm yard manure 125% of RDN	4011.70	1.80
T ₇	Leaf litter 75% of RDN	2513.00	1.60
T ₈	Leaf litter 100% of RDN	2474.70	1.56
T ₉	Leaf litter 125% of RDN	2030.90	1.63
T ₁₀	Neem cake 75% of RDN	1592.60	1.05
T ₁₁	Neem cake 100% of RDN	1675.00	1.17
T ₁₂	Neem cake 125% of RDN	2020.40	1.12
T ₁₃	75% of GRDF	3342.00	1.73
T ₁₄	100% of GRDF	3282.70	1.77
T ₁₅	125% of GRDF	4598.10	1.81
	MEAN	2905.20	1.55
	SE	3.98	0.01
	LSD _{0.05}	11.52	0.04

CONCLUSION

From the present findings, it may be concluded that increased rhizome yield and essential oil content of *Acorus calamus* can be obtained with the application of Farm yard manure in 100% recommended dose of nitrogen. Hence, FYM is beneficial for increasing the rhizome yield and essential oil content of Sweet flag for the zone of study.

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