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POTASSIUM NUTRITION RELATED BIOMASS AND WAX PRODUCTIVITY OF *EUPHORBIA ANTISYPHILITICA* ZUCC. IN SAND CULTURE

NEERU GUPTA* AND N.K. MEHROTRA**

**Central Institute of Medicinal and Aromatic Plants, Lucknow-226 105*

***Botany Department, Lucknow University-226 007, India*

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A controlled sand culture study of the effect of graded K_2SO_4 supply (0.01 to 20 m*M*) on the biomass and wax productivity of a laticiferous potential petrocrop, *Euphorbia antisyphilitica* Zucc. revealed that (i) maximum biomass as well as wax content and yield was found at 4 m*M*, (ii) potassium deficiency adversely affects their epicuticular wax deposition, (iii) Scanning Electron Microscopic studies of the comparable young phylloclades tissues of the deficient (<0.01 m*M*) and sufficient (4 m*M*) potassium plants also indicated that K has a role in epicuticular wax deposition in *Euphorbia antisyphilitica* Zucc. plants.

Key Words : Potassium Nutrition, Wax productivity, Petrocrop, *Euphorbia antisyphilitica.*

Euphorbia antisyphilitica. Zucc. is a native of Mexico and wide spread on different arid and semi-arid parts of the world. It is a good source of Candellila wax, content 2-5%, which is epicuticular in nature (Standley, 1923; Paroda *et al.*, 1986). Wax is commercially important and utilized in the manufacture of polishes, varnishes, sealing wax and chewing gums (Vimal & Tyagi, 1988). Major constituents of the epicuticular wax are triterpenol and triterpene ketones (Gulz *et al.*, 1987, Knops *et al.*, 1991). Accordingly, this paper deals with the effect of graded K supply on the biomass and wax productivity of *E. antisyphilitica,* an important petrocrop, specially in the Indian context (Srivastava, 1986).

Four weeks old plantlings of *Euphorbia antisyphilitica.* Zucc. initially raised through cuttings in purified silica sand, were transplanted and grown at six graded levels of K<0.01-Ko, 0.4-K_1, 1-K_2, 4-K_3, 8-K_4 and 20 m*M*-K_5) supplied as K_2SO_4 in refined sand culture (Agarwala & Sharma, 1976). Clay flower pots (25 cm diam), having central drainage hole and whose inside surfaces were painted twice with bitumen and lined with alkathene were used. There were 4 pots at each level of K supply, having 3 plantlings per pot. The nutrient solution was supplied daily except at week ends, when the pots were flushed with deionised water.

In fresh comparable young phylloclade tissues, epicuticular wax was extracted and estimated at 46 and 74 weeks after transplantation interval (Radin *et al.*, 1982). At both the stages, tops and roots were harvested separately and estimated for fresh and dry matter yield. Scanning Electron Microscopy (SEM) (Singh *et al.*, 1988) was done of the comparable (<0.01 m*M*) and sufficient (4 mM) potassium plants at 46 wap. All the data were statistically analysed and tested for significance between any two observations (Panse & Sukhatme, 1985) at $P < 0.05$.

Biomass of tops as well as roots was found maximum at 4 m*M* K supply (Table 1). Adequate K related maximisation in biomass as observed for *E. antisyphilitica* was also reported for other petrocrops like *E. lathyris* (Kingsolver, 1982; Garg & Kumar, 1988) and for *E. antisyphilitica* (Johari & Kumar, 1992).

Besides decreasing the top biomass, both K-deficiency (<1 m*M*) and its excess (>8 m*M*) markedly

Table 1 Effect of graded K-supply on the biomass and concentration and yield of epicuticular wax in *Euphorbia antisyphilitica* Zucc. grown in sand culture.

Attributes	Growtgh stage (watp)*	K-supply (m*M*)						
		Optimal	Sub-optimal			Supra-optimal		LSD P=0.05
		4	<0.01	0.4	1	8	20	
		Actual value	% increase(+) or decrease (–) over optimal					
Biomass (g plant⁻¹)								
· top	46	69.2	–41	–30	–25	–44	–58	14.6
	74	97.4	–48	–26	–2	–7	–22	15.0
· roots	46	6.5	–35	–29	–55	–27	–55	2.4
	74	12.9	–55	–31	-3	–16	–33	4.1
Wax								
· Concentration (% dry matter)	46	6.46	–28	–18	–16	–14	–25	1.9
	74	6.42	–32	–29	–6	–22	–7	2.2
· yield	46	4.33	–56	–40	–35	–51	–67	1.4
	74	6.30	–67	–49	–8	–27	–30	2.6

*weeks after transplanting

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decreased the concentration of epicuticular wax (Table 1). This resulted in even higher magnitude of decrease in the wax yield of both sub and supra optimal K plants (Table 1). Maximum concentration (6.4-6.5% dry matter) as well as yield (4.3-6.3 g plant^{-1}) of Candellila wax was found at 4 m*M* K (Table 1), the level at which marked uniform deposition of epicuticular granular wax also indicated through SEM studies (Fig. 2).

The comparative SEM (Fig. 1) preparations of the K-deficient (<0.01 mM) and sufficient (4 m*M*) potassium phylloclade tissues revealed that K-deficiency adversely affected their epicuticular deposition. In 4 m*M* K plants, the deposition of granular wax was thick and fairly uniform over the entire epidermal cell surface (Fig. 2), being specially prominent over walls of the guard cells. In contrast, in nil K supply (<0.01 mM) plants the wax deposition was irregular and mostly peripheral in the form of amorphous mass over the epidermal cells and very little over the walls of guard cells projecting stomatal outlines at pits (Fig. 1). The SEM studies thus indicated that K has a role in the epicuticular wax deposition in *Euphorbia* plants.

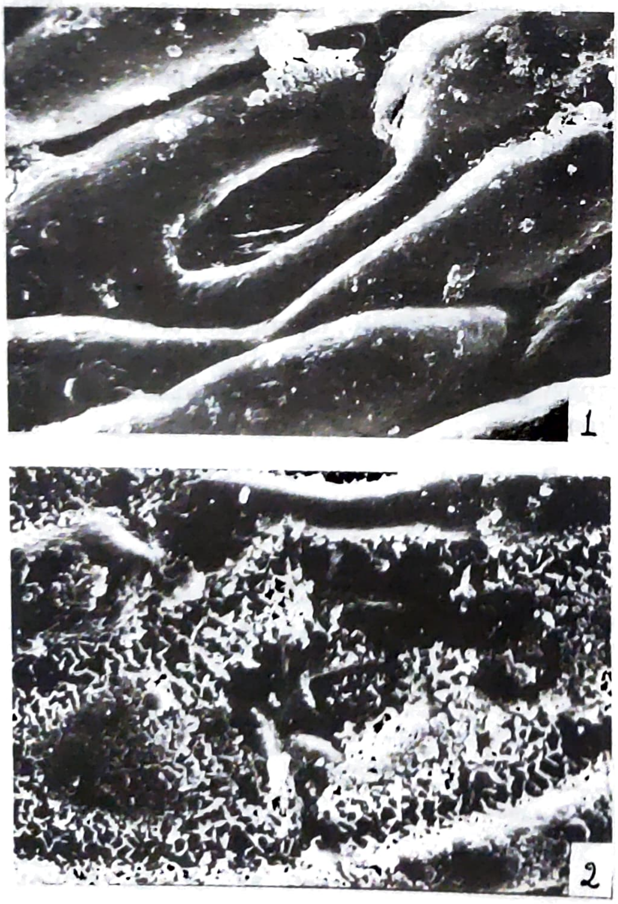

Figure 1, 2 Scanning Electron Micrographs (SEM) of the young phylloclade surfaces of *Euphorbia antisyphilitica* Zucc. plants grown in sand culture at 46 wap X-1500. Fig. 1. K-deficient (<0.01 m*M*) epidermal cells showing irregular, peripheral, amorphous mass of wax. Fig. 2. K- sufficient (4 m*M*) epidermal cells showing granular, thick uniform wax.

This adequate K-related maximisation of secondary metabolite wax (alkanes) could be direct/indirect through effect on increasing photosynthesizing capacity (Rudall, 1987), and/or through sugar and amino acid incorporation in the biosynthesis of secondary metabolites (Knops *et al.,* 1991a) specially of lipids and triterpenes where they are reported to be very effective as precursors (Groeneveld *et al.,* 1982).

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