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Effect of season and plant bio-regulators on hardwood cutting of seabuckthorn (*Hipophae salicifolia*) under Garhwal Himalayas*

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Seabuckthorn (*Hippophae* spp) is a thorny, deciduous, shrub belonging to family Elaeagnaceae and distributed widely in the cold arid regions of Himachal Pradesh, Uttarakhand, Ladakh region of Jammu and Kashmir and some parts of Sikkim. In Uttarakhand it is locally known as Amesh and has been found to grow naturally in various parts of the Uttarakhand including Niti, Mana, Virhi, Har-ki-Dun, Yamunotri valley, Harsil, Rambana areas in Garhwal and Munsiari and Dharchula region in the Kumaon. Out of 3 species found in India, only 2 species, i e *Hippophae salicifolia* D. Don, and *Hippophae tibetana* S. are reported from Uttarakhand (Dwivedi *et al*. 2006). *H. salicifolia* is the most common and economically important species and distributed from 1500 to 3500 m above mean sea level (Yadav *et al.* 2009). Seabuckthorn is a plant which has got global attention due to its rich medicinal properties and its role in environmental conservation of degraded mountainous lands. It is also being used for aforestation programmes for greening of hilly regions (Lu-Rongsen 1992). This is perhaps, the most commonly used plant for the purpose of fuel, fence, medicine and fruits by the local people (Chaurasia and Singh 1996). Fruits of the seabuckthorn are quite rich in vitamin C, A, B_1, B_2, E, K and other nutrients, like protein, carotenoids and flavonoids. Oil extracted from its fruits and seeds is used for life-saving drugs for combating numerous diseases as cancer, blood pressure, heart problems, ageing and memory loss etc. (Xu Mingyu 1994). Seabuckthorn can be propagated through sexual and asexual means, like seeds and cuttings. The plant raised from seeds cannot maintain the biological characteristics that are not genetically identical to the selected mother plant. The most valuable economic features of its fruits are lost during growing seedlings from seeds because of high level of their heterozygosity. Therefore, for cultivation of seabuckthorn as fruit and medicinal crop it is important to apply such methods of its propagation, which would ensure production of genetically uniform plants, keeping integrity and similarity with mother plants by their economic and valuable features. A hardwood cutting is one of the promising methods of asexual propagation of seabuckthorn. It is possible to produce cheaply grown genetically uniform own-rooted seedlings in short time and in large amounts using this method. The cutting takes roots easily, but the rate of rooting is uncertain and susceptible to environmental conditions of different regions. Rooting of cutting may be affected by time of collection of hard wood cutting and treatment of cutting with growth hormones. Keeping in view of above points and importance of *H. salicifolia* an experiment was conducted to find out the effect of season and growth hormone treatments on rooting (%), roots/cutting, average root length (cm), shoots/cutting and average shoot length (cm) in the hard wood cuttings of seabuckthorn under mid hill conditions of Garhwal Himalayas.

A study was conducted during 2005–06 at College of Forestry and Hill Agriculture, Hill Campus, Ranichauri, Tehri Garhwal, Uttarakhand which is situated at an altitude of 2000 m above mean sea level during 2005–06 to standardize asexual method of propagation in seabuckthorn through stem cutting, in which 1-year-old pencil thickness, 22.86 cm long cuttings were taken in 2 different season, ie November and March from female plants. The cuttings were treated with various concentrations (200–600 ppm) of plant growth regulators (Indole butyric acid, naphthalene acetic acid (NAA), and indole acetic acid (IAA) for 12 hr at ambient condition. The cuttings were then planted in polybags containing mixture of sand and soil at an angle of 45°, leaving 2–4 buds above the soil surface, immediately after the planting irrigation was made. The experiment was laid out in randomized block design with 3 replications/treatment and 25 cuttings/replication.

*Short note

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Table 1 Effect of season and plant bio-regulators on rooting and growth characteristics of seabuckthorn

Treatment	Rooting (%)	Roots/ cutting	Average root length (cm)	Shoots/ cutting	Average shoot length (cm)	Rooting (%)	Roots/ cutting	Average root length (cm)	Shoots/ cutting	Average shoot length (cm)
	November cutting					March cutting				
IBA 200	5.00	2.63	4.10	2.27	9.97	22.06	3.90	4.20	3.50	12.00
IBA 400	24.03	8.59	8.26	6.43	18.60	53.76	8.36	8.87	7.17	24.67
IBA 600	13.50	6.40	6.57	1.43	9.37	49.80	7.37	8.40	6.37	23.10
NAA200	6.26	3.13	4.20	1.23	8.27	14.17	2.53	4.53	4.30	16.30
NAA 400	11.43	3.06	6.19	2.40	6.47	31.77	3.53	6.67	3.33	14.67
NAA 600	14.06	3.33	6.53	3.20	12.30	32.77	3.73	6.90	4.63	12.20
IAA200	10.67	2.43	6.50	2.33	6.73	26.40	3.87	4.47	2.43	10.63
IAA 400	17.40	6.33	5.10	1.60	11.23	34.50	8.13	7.69	6.47	20.23
IAA 600	19.77	4.50	3.20	4.60	13.30	46.77	7.20	8.47	6.43	18.30
Control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CD (P=0.05)	1.25	0.33	0.39	0.27	1.16	2.19	0.51	0.42	0.29	0.91

Data presented in Table 1 indicate that very poor rooting was obtained in hard wood cuttings which were taken during November while significantly higher rooting was observed when plant bioregulator treatments were given to the cuttings taken during March. It was also observed that very low rooting was obtained when exogenous application of rooting hormones was not given, though hard wood cutting was taken in March. Thus exogenous application of a suitable rooting hormone is also essential. This confirms the finding of Lu-Rongsen (1992). Effect of various treatments, viz IBA, NAA and IAA treatments on rooting (%) in seabuckthorn cuttings showed a wide variation (5.00–53.76%). The cuttings taken during March showed higher rooting (14.17–53.76%) than those cutting taken during November (5.00 – 24.03%) (Table 1). The maximum rooting (53.76%) was observed when cuttings taken during March, followed by treatment with 400 ppm IBA. It was also observed that very low rooting was obtained when exogenous application of rooting hormones was not given, as seen in the control group. Singh (1995) reported 500 ppm NAA was found ideal for rooting under Himachal Pradesh Conditions. Difference in species, altitude, agro-climatic conditions and planting time may have contributed to this variation. Various treatments affected the number of roots/cutting (2.43–8.36). Best results were recorded when cuttings were taken in March when average day temperature was 18.5 °C and mean night temperature was 12.3°C, followed by 400 ppm IBA (Table 1). The exogenous application of optimum concentration of IBA is essentially required for rooting which influences positively the number of roots formed/cutting (Pathak 1991). A similar trend was recorded for average root length, where longest root (8.87 cm) was recorded in 400 ppm IBA, followed by 600 ppm IBA treatments (8.40 cm). These bioregulator treatments were significantly superior to rest of the treatments. Higher nutrient uptake by cuttings under these treatments resulted higher per cent rooting and maximum number of roots formed/cutting, as observed in the present study the highest (24.67 cm) with 400 ppm IBA in cuttings taken during March. The best result with 400 ppm IBA for maximum number of shoots and shoot length may because of higher rooting (%), higher number of roots/cutting and longer roots which results in better nutrient uptake and subsequently, better shoot formation and faster growth of the shoots (Sadhu 1989).

SUMMARY

An experiment was conducted during 2005–06 to standardize vegetative method of propagation through hard wood cutting in Seabuckthorn (*Hipophae salicifiolia* D. Don.), an emerging horticultural crop in India. It was found that different times of cuttings and levels of exogenous plant hormones significantly affected the rooting percentage, roots/cutting, average root length, shoot length and shoots/cutting parameters recorded in the study. Best results were recorded when cuttings were taken in March compared to November. Among different plant bio-regulators IBA 400 ppm gave better results compared to all other treatments. Over all it was concluded that hard wood cuttings taken in March and treated with 400 ppm IBA can be used for the propagation of *H. salicifolia* under Garhwal Himalaya conditions.

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