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Effect of Pre Planting Moisture Treatments on Sprouting and Yield Attributes of *Picrorhiza kurrooa Royle Ex Benth*

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ABSTRACT

Picrorhiza kurrooa Royle ex Benth is an endangered, high value, perennial medicinal plant which is generally propagated through cuttings. However rooting of cutting is affected by several factors like portion of cutting and pre planting teaments. Studies were undertaken to standardize portion of the stolon from which cutting should be taken and pre-planting moisture treatments to observe the effect on sprouting, survival and yield attributes. It was observed that top portion of stolon cuttings should be preferred over middle and basal potion for maximum sprouting and rootstock yield. Stolon cuttings should be kept in moist jute bags for nine to twelve days before planting to get higher survival and yield.

INTRODUCTION

Picrorhiza kurrooa is native to Western Himalayan region, distributed along stream borders and moist rocks of temperate and alpine zone between 3000-5000 m elevations. It is a creeping, glabrous perennial herb and is often found gregarious in its natural habitat. It is commonly known as Kutki/Karru and belongs to the family scrophulariaceae. It is an important species considering its demand and use vis-à-vis threat status. It is a high value medicinal plant used in both traditional as well as modern systems of medicine, the rootstock of which constitutes the drug.

The rhizomes and roots of *P. kurrooa* are medicinally important as hepatoprotective, stomachic, anti-periodic, anthelmintic, laxative, cardiotonic, anti-diabetic, anti-cancerous, cholagogue, diuretic, cooling, appetizer, anti-asthamatic and also used to cure vitiligo, leucoderma, jaundice and viral hepatitis (Chopra et al. 1956; Shah 1969; Mehta 1982; Bedi et al. 1989; Kaul and Kaul 1996; Sinha 1996; Singh 1999; Jeena et al. 1999 and Joy and Kuttan 1999), and such rootstock is a major component of various formulations like Picroliv, Arogyavardhni vati, Laxminarayan Ras, Mahayograj Guggulu, Amritarista, Curminil Syrup, Livertone, Curminex, P K-300, Ayush-64 etc. (Yegnanarayan et al. 1982; Vaidya et al. 1996; Singh 1999; Gogte 2000 and Valecha et al. 2000)

Harvesting of its stolons for drug/commercial purpose leads to destructive harvest with little regeneration activity being taken up at present. Moreover, the local people who were dependent on this commercially viable species for augmentation of their cash earnings are facing a lot of difficulty in meeting their day to day

requirements in the lack of its natural regeneration process. If this situation is allowed to continue this important drug plant, which is categorized as endangered by the IUCN, will become extinct one day. Moreover high commercial demand of *P. kurrooa* coupled with good market price is attracting herbal traders with scanty attention being given to its conservation or cultivation. The resulting decline in its natural regeneration processes has not only put its status under threat but also adversely affected the trade and commerce of related industry.

Due to indiscriminate and non-systematic exploitation from wild, the species has become vulnerable and its populations are becoming scarce (Nayar and Sastry 1987). The plant populations have been reduced significantly in the easily accessible area and now it is restricted only to the inaccessible terrain (Kala, 2004). Due to these reasons the species is now classified as a critically endangered and also finds place in the negative list of export of Ministry of Commerce, GOI [Vide Notification No. 03 (RE-2003)/2002-2007 (Appendix II) dated 31st March, 2003 issued by Director General of Foreign Trade, Govt. of India].

Despite increasing national and international demand, *P. kurrooa* is largely extracted from its wild habitat and with very limited cultivation. The only way this species can be saved from extinction and also for its sustainable utilization, large-scale cultivation is necessary. However, for any large scale cultivation there is need of efficient propagation technique. The available propagation technique on this endangered Himalayan plant species is insufficient and mostly limited to the closets. Keeping this in view the present studies will be undertaken to develop/standardize/improve its propagation technique which will be useful to the farmers in successful propagation/cultivation of this high value medicinal plant thereby generating their cash income. This will also be making available fresh, genuine and quality raw material free from harmful chemicals on sustainable basis to the drug industry.

MATERIALS AND METHODS

The present study was undertaken at Medicinal and Aromatic Plants Research Station, Rahla of Dr. Y.S. Parmar University of Horticulture and Forestry at Nauni, Solan (HP) during 2005 to 2007. The site is located an altitude of 2750 m amsl. The surface (0-15 cm depth) and sub-surface (15-30cm depth) soil of the experimental site was acidic in reaction (pH 5.5 to 5.7) with safer EC value (0.091 to 0.115 ds/m), medium to high in organic carbon (1.92 to 1.68 %) and available N (407.68 to 332.41 Kg/ha), P (44.80 to 40.32 Kg/ha) and K 333.40 to 296.80 Kg/ha). The area with deep fertile soil and nice undulating topography receives heavy snowfall and is highly conducive for cultivation of medicinal and aromatic plants of temperate and alpine region.

The studies elucidate sprouting, survival and yield performance of *P. kurrooa* by employing top, middle and basal portion of stolon cuttings pretreated for varying period of time interval in moist jute bags. Uniform sized (6 cm) stolon cuttings taken from top, middle and basal portion of stolon were kept in moist jute bags for 21 days till no cutting sprouted during May, 2005. Observations on sprouting were recorded at 3 days interval till 21 days to find out the number of cuttings sprouted vis-à-vis cumulative sprouting. The sprouted cuttings were then planted in the field at a spacing of 25 x 25 cm and observed for yield attributes after one and a half; and two and a half years of plant growth during October, 2006 and 2007. The experiment was laid out in RBD with twenty one treatments and three replications.

Randomly selected five plants per replication were dug out after first and second growing season in the month of October and washed thoroughly to remove all adhering soil particles. These plants were shade dried for 10 days followed by oven drying at 50°C till no further weight loss was observed. These oven dried plants were separated into leaves and rootstock (stolon plus roots) and weighed. Rootstock-shoot ratio was calculated by dividing the rootstock weight by leaf weight and is reported as mean.

RESULTS AND DISCUSSION

Cutting taken from top portion of stolon gave maximum sprouting right from third day of observation till end of the experiment i.e. 21 st days except 15th and 18th days where maximum sprouting was noticed with basal portion of cutting (Table 1).

Table 1. Effect of cutting portion and pretreatment in moist jute bags on performance of *P. kurrooa*

Treatments	Sprouting (%)	Cumulative Sprouting (%)	Leaf yield (g/plant)		Rootstock yield (g/plant)		Rootstock yield (kg/ha)		Rootstock: shoot ratio	
			2nd year	3rd year	2nd year	3rd year	2nd year	3rd year	2nd year	3rd year
Top Portion										
T_1(3 days)	20.10	20.10	1.36	2.15	2.28	4.08	364.80	652.80	1.68	1.90
T_2((6 days)	28.64	48.74	1.46	2.10	2.58	3.94	412.80	630.40	1.77	1.88
T_3(9 days)	8.25	56.99	1.68	2.45	2.78	4.58	444.80	732.80	1.65	1.87
T_4(12 days)	8.18	65.17	1.70	2.64	2.46	4.82	393.60	771.20	1.45	1.83
T_5(15 days)	2.56	67.73	1.55	1.86	2.52	4.10	403.20	656.00	1.63	2.20
T_6 (18 Days)	2.00	69.73	1.40	1.90	2.18	3.96	348.80	633.60	1.56	2.08
T_7(21 days)	2.34	72.04	1.05	1.84	2.20	3.22	352.00	515.20	2.10	1.75
Middle Portion										
T_8(3 days)	14.42	14.42	1.14	2.14	2.10	3.75	336.00	600.00	1.84	1.75
T_9(6 days)	2.14	16.56	1.38	2.04	2.46	3.92	393.60	627.20	1.48	1.21
T_{10}(9 days)	2.69	19.25	1.46	2.28	2.32	3.90	371.20	624.00	1.59	1.71
T_{11}(12 days)	4.21	23.46	1.18	2.26	2.41	4.36	385.60	697.60	2.04	1.93
T_{12}(15 days)	2.14	25.60	1.26	2.44	2.10	4.18	336.00	668.80	1.67	1.71
T_{13}(18 days)	2.24	27.84	1.10	1.95	2.15	3.55	344.00	568.00	1.95	1.82
T_{14} (21 days)	2.05	29.89	0.92	1.82	1.95	3.46	312.00	553.60	2.12	1.90
Basal Portion										
T_{15} (3 days)	8.34	8.34	1.16	2.12	2.32	3.88	371.20	620.80	2.00	1.83
T_{16}(6 days)	4.36	12.70	1.55	2.36	2.64	4.10	422.40	656.00	1.70	1.74
T_{17}(9 days)	8.33	21.03	1.66	2.34	2.66	4.62	425.60	739.20	1.60	1.79
T_{18}(12 days)	4.66	25.69	1.36	2.58	2.40	4.76	384.00	761.60	1.76	1.84
T_{19}(15 days)	4.23	29.92	1.20	1.98	2.26	4.00	361.60	640.00	1.88	2.02
T_{20}(18 days)	2.66	32.58	1.22	2.10	2.05	3.88	328.00	620.80	1.68	1.85
T_{21}(21 days)	2.33	34.91	1.01	1.96	2.04	3.70	326.40	592.00	2.02	1.89
CD 0.05	**8.10**	**15.75**	**0.16**	**0.28**	**0.42**	**0.78**	**24.10**	**28.35**	**0.12**	**0.26**

Cumulative sprouting was also observed higher with top portion of cutting followed by basal portion and minimum with middle portion of cutting at the end of the experiment on 21st day. Treatment T_{21} gave minimum leaf yield (1.01 g plant^{-1}) during second year and T_{14} (1.82 g plant^{-1}) in the third year of plant growth whereas; T_4 recorded the maximum 1.70 and 2.64 g plant^{-1} during second and third year of plant growth respectively. Maximum root stock yield of 444.80 Kg ha^{-1}was observed for T_3which are statistically at par with T_{17} (425.60 kg ha^{-1}) during 2nd year of growth. Whereas, during 3rd year of plant growth, maximum root stock yield was observed in T_4 (771.20 kg ha^{-1}). While minimum rootstock yields of 312.00 kg ha^{-1} and 515.20 kg ha^{-1} was observed for T_{14} and T_7 in 2nd and 3rd year of plant growth respectively. Rootstock: shoot ratio depicted its highest (2.12) in T^{14} followed by 2.10 in T_7 whereas, lowest 1.45 value was observed in T_4 following T_9 (1.48) in the second year of plant growth. In the third year of growth, rootstock: shoot ratio showed highest (2.20) value in T_5 followed by T_6 (2.08) whereas, lowest (1.21) value was recorded in T_9 (Table1).

Alpine plants are generally multiplied asexually by using stem cuttings (Hills 1959). *P. kurrooa* can be vegetatively propagated through stolon cuttings (Anonymous 1969). It is also well known that rooting of cutting is affected by several factors like cutting size, portion of cutting, pre-planting treatments etc. However, there is little information available with respect to the optimum stolon cutting size and the portion of the cutting (top, middle and basal) used for planting to get better field survival and rootstock yield. It is evident from the results obtained during present investigation that *P. kurroa* can be successfully multiplied through stolon cuttings within a short period of time, which is also supported by the earlier studies (Nautiyal et al. 2001).

Moisture/water is essential for the structural integrity of biological molecules, cells, tissues and the organism as a whole besides performing vital role in translocation of nutrients in the plant is well known. Use of water as a rooting media is definitely going to be quite beneficial in the long run as cheap production of nursery stock is always the inherent objective of any propagation experimentation. Results obtained during present investigation revealed that the sprouting and yield parameters viz. leaf, rootstock yield and rootstock shoot ratio in *P. kurrooa* has been significantly influenced by the pre-planting treatments of moisture to the stolon cuttings. The observation confirms earlier reports of significant re-sprouting in damaged stolons of *P. kurrooa* through water culture (Sharma and Raj 2001). Similar results were reported by Mehra (2006).

Stolons collected from nature and divided into top and basal segments of approximately 5 cm size, can be used as planting material (Nautiyal et al. 2001). Rooting of cutting is affected by several factors like chemicals (endogenous and exogenous which promote rooting), plant stages (juvenility, cutting size, presence of bud and/or leaves etc.), environment (humidity, light, bottom heat, photoperiod etc.), media, wounding etc. (Couvillon 1988). In addition to this, rooting is also affected by other chemical factors like level of carbohydrates in cuttings (higher levels promote rooting) and fungicidal treatment (promotes rooting due to the control of pathogen or as a synergistic with or without hormones

CONCLUSIONS

Moisture/water is essential for the structural integrity of biological molecules, cells, tissues and the organism as a whole besides performing vital role in translocation of nutrients in the plant. It was deduced from the studies that top portion of stolon should be preferred over middle and basal potion of the cutting for maximum sprouting and rootstock yield. Stolon cuttings should be kept in moist jute bags for nine to twelve days before planting to get higher survival and yield.

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