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# ECOLOGICAL STUDIES ON *HIPPOPHAE RHAMNOIDES* LINN. IN SPITI VALLEY OF HIMACHAL PRADESH

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**ABSTRACT**

The study was conducted in the cold desert of Spiti Valley in the state of Himachal Pradesh. Plantation of *Hippophae rhamnordes* Linn in one hectare area can meet the fuelwood needs of twenty families in this region. Total biomass dry weight basis was 34.27 t/ha and energy ranged from 3.5 to 4.4 K. cal/g dry weight.

## INTRODUCTION

*Hippophae rhamnoides* Linn., a dioecious spinescent shrub or a small tree, belongs to family Elaeagnaceae and grows widely in the drier interior ranges of the north-western Himalayas bordering Tibet at an altitude range of 2850 to 4500 m (Brandis 1972). It grows gregariously on shingly ground. Flowers appear in late May-June, fruit formation takes place in September and October and seeds mature in November-December. Seeds are enclosed by succulent layer of orange-yellow colour and are oblong in shape. The fruit is acidic and is made into a jelly with sugar. A syrup is prepared from it which is used as a cure for lung complaints. In the Spiti valley, *H. rhamnoides* is used as fuel and for making charcoal. The cold desert area of Himachal Pradesh constitutes about 24.85% of geographical area of the State. This area is characterized by high wind velocity, low rainfall, heavy snowfall, which is the main source of moisture to the vegetation, high incident radiation and evaporation and low atmospheric humidity. This region has very little vegetation on steep hill slopes but more of it appears on comparatively flat areas which have better moisture regime or are irrigated (Singh and Gupta 1990 a).

Attempts have been made to determine the biomass, energy contents, seed germination and vigour parameters, of *H. rhamnoides* in the present investigation.

## MATERIAL AND METHODS

The present investigation was carried out at Tabo and Poh which are 47 and 37 km from Kaza towards north-west at 78°2.5′ East longitude and 38°3.7′ North latitude and their altitudes vary between 3130 and 3250 m above mean sea level. Two hundred plants of different sizes were harvested for biomass estimation of different

plant parts such as stem, branches, twigs, leaves and roots. Fresh and dry weights of different parts of individual plants were recorded. Root system was dug out to its full depth and roots upto 0.1 cm dia meter were taken into consideration. Dry samples of each part were ground into fine powder for energy estimation through Oxygen Bomb-Calorimeter. The average value of nine replications for each part is presented in the present investigation. Each plant that was used for biomoss estimation was also measured for vigour parameters such as height, collar diameter and crown area. Seeds were collected from Tabo aeea during the first week of December 1989 and seed germination trials were conducted in the laboratory in B.O.D. seed germinator at 35.0 ± 2.0°C. One hundred quadrats of 1 $m^2$ were laid down randomly to determine the density of *H. rhamnoides*.

## RESULTS AND DISCUSSION

### Morphological characters and biomass

The vigour characters (Table 1) make it an ideal species for checking soil as well as wind erosion in the cold desert areas. Branches and twigs contribute maximum (35.3%) to the total biomass followed by stem (32.2%), root (27.6%) and leaves (4.8%). The leaves are browsed by sheep and goat. The sheep and goat even eat dried leaves fallen on the ground. Non-photosynthetic and photosynthetic ratio indicates that stem and branches + twigs grow in more quantity than the in leaves. Above ground and underground biomass ratio also indicates that production of aerial portion is higher than the underground portion. The same trend was observed in *Indigofera gerardiana* by Singh et al. (1990). On an average the density of *H. rhamnoides* was observed 41,000 ± 12543.66 plants/ha and therefore, the average biomass of different plant parts works out to 11069.18 kg/ha stem; 12106.07 kg/ha branch + twigs; 1636.31 kg/ha leaves and 9467.72 kg/ha roots, respectively.

### Seed germination

The seed germination tests (Table 2) indicate that seed of *H. rhamnoides* has no dormancy and the seed remains viable for over one year.

Seed germination in *H. rhamnoides* is completed between 17 and 21 days. Germination tests were also conducted without removing the pulp from the seeds to see its effect on seed germination. Seed with pulp gives 20.6 ∓ 7.83% seed germination and takes 35 and 62 days.

### Energy

The calorific value ( cal/g dry weight ) of stem was recorded maximum (4430.3 ± 87.6) followed by branches + twigs (4361.0 ± 73.3), root (4108.0±37.9) and leaves (3577.1 ± 61.4). Maximum energy contents were observed in leaves by different workers in different plant species because leaf is the factory of carbo-hydrates production in the presence of chlorophyll through photosynthesis (Singh 1980;

Table 1. Vigour parameters and biomass of different plant parts of *Hippophae rhamnoides*.

| Plant height (m) | Collar diameter (cm) | Crown area ($cm^2$) | Aboveground biomass (g/plant) | | | Below ground biomass (g/plant) | Total biomass (g) | Non-photosynthetic/ photosynthetic part ratio | Above-ground/ below-ground ratio |
|---|---|---|---|---|---|---|---|---|---|
| | | | Stem | Branches + twigs | Leaves | | | | |
| 2.04 | 2.52 | 3572.50 | 269.98 | 295.27 | 39.91 | 230.92 | 836.08 | 14.16 | 2.62 |
| ± 0.60 | ± 0.64 | ± 907.37 | ± 128.18 | ± 171.26 | ± 33.71 | ± 104.55 | | | |
| (0.75 | (0.80 | (500.2 | (67.30 | (66.38 | (7.68 | (56.15 | | | |
| to | to | to | to | to | to | to | | | |
| 3.45) | 3.97) | 11550.7) | 588.89) | 713.66) | 166.49) | 547.48) | | | |

Figures in paranthesis are the range of minimum and maximum of a character.

Table 2. Sced germination of *H. rhamnoides*

| Date of sowing | Germination (%) | Number of days |
|---|---|---|
| 24.12.89 | 100 | 19 |
| 06.01.90 | 100 | 17 |
| 28.05.90 | 100 | 21 |
| 23.07.90 | 100 | 19 |
| 03.10.90 | 100 | 20 |

Sharma and Singh 1975), but in present study leaves have minimum energy content which may be due to continuous leaves grazing by sheep and goat. The same pattern was observed in *Debregeasia hypoleuca* by Singh and Gupta (1990 b), where leaves have minimum energy content due to continuous lopping for fodder. Total energy content of *H. rhamnoides* were recorded 3575 K. cal/plant. The contribution of twigs + branches was observed maximum (1287. 6 K cal) to the total energy biomass followed by stem (1196.1 K cal), roots (948.6 K. cal) and leaves (142.7 K. cal) in that order. On hectare basis, total energy content of this species were recorded 146.6 lakh K. cal and the contribution of different plant parts was same as in case of energy biomass.

Cooking and heating energy requirement of villager having five family members will be about 12.5 lakh K. cal/year (Singh 1978). The calorific value of *H. rhamnoides* is 3.5 to 4.4 K cal/g (average about 4.0K. cal/g) and its total production is 34.27 t/ha. Thus, plantation of this plant species in one hectare area can meet the fuelwood requirements of twenty families in the Spiti valley.

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