

# **Studies on the Eco-Physiology of Early Successional Plant Populations of Jhum Fallows**

**ABSTRACT**

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Slash and burn agriculture (locally known as Jhum) is the most prevalent form of cropping in the hill areas of north-eastern India. The early successional herbaceous communities constitute an important phase in the fallow development during secondary succession subsequent to cropping. This community which holds the ground for about 5-6 years, often gets arrested at this stage due to shortening of the Jhum cycle (the intervening fallow period before cropping is again done on the same site). The present study deals with the eco-physiological analysis of this community and a comparison with the herbaceous communities of older fallows of secondary succession which is important both from the view points of understanding the biological and environmental aspects related to Jhum. *The study was carried out in Byrnihat in the Khasi Hills (26°N and 91.5°E).*

#### 1. Organization of herbaceous weed communities under Jhum:

Organization of herbaceous weed communities was studied under 4, 6, 10 and 20 year Jhum cycles. Under shorter Jhum cycles of 4 and 6 years, the species of the pre-burn stage reestablished subsequent to the burn whereas under longer cycles of 10 and 20 years shade tolerant herbaceous species of the pre-burn stage were replaced by more competitive and ruderal species after the burn. Abundance as well as biomass of weeds was significantly

higher under shorter cycles of 4 and 6 years as compared to longer cycles of 10 and 20 years. Further, the density and biomass values were significantly higher in the uncropped sites than that in the cropped sites under all Jhum cycles. Diversity indices based on numerical abundance increased sharply immediately after the burn under all the cycles. However, while diversity index based on biomass increased sharply after the burn under 4 and 6 year cycles, reverse was the case under 10 and 20 year cycles. Weed problem has been discussed in relation to the length of Jhum cycle.

2. Germinable seed population <sup>in</sup> soils:

Germinable seed population in soil was estimated under 4, 6, 10 and 20 year Jhum cycles at three times - just before the burn, immediately after the burn and after one year of cropping. At all the sampling times, the total number of germinable seeds was significantly higher under 4 and 6 year Eupatorium dominated cycles compared to 6 year Imperata dominated, 10 year and 20 year ones at all samplings. Though there was no significant difference between 6 year Imperata dominated fallow and 10 or 20 year fallows at the pre-burn stage, the former had significantly higher number at the immediate post-burn stage and after one year of cropping. The number of germinable seeds decreased after the burn and cropping and it was more pronounced in case of

longer cycles of 10 and 20 years. Species like Eupatorium odoratum, Erigeron linifolius and Ageratum conyzoides were more abundant after cropping as compared to others. Results are discussed in light of the weed problem in relation to the length of Jhum cycle.

### 3. Partitioning of biomass and nutrients in the secondary successional herbaceous populations:

Three categories of secondary successional herbaceous communities subsequent to slash and burn viz. early successional non-sprouting, early successional sprouting and late successional populations were analysed for their resource allocation pattern, nutrient uptake efficiency and seed production efficiency. Early successional non-sprouters directed a higher proportion of resources to stem and seed components whereas late successional populations allocated a greater proportion to leaf and below-ground components. The former was also more efficient from the point of seed production and nutrient uptake. Early successional sprouting populations also directed a lesser proportion to the leaf component than that of late successional ones but a higher proportion was allocated to the underground organs of regeneration instead of to the sexual propagules as in the early successional non-sprouters. Sexual reproductive potential was found to be

dependent upon the vigour of the plant in the early successional non-sprouters whereas in the other two categories no significant relationship existed. In the early successional non-sprouting perennials resource allocated to seed was more dependent upon the total available resource as compared to the annuals where the vigour of the plant is less critical. The findings are discussed in relation to the adaptive strategy during post-fire succession.

4. Reproductive efficiency of secondary successional herbaceous populations:

Three categories of secondary successional herbaceous communities subsequent to slash and burn, viz. early successional non-sprouting, early successional sprouting and late successional populations, were investigated for their reproductive efficiency considering leaf component since it is the chief organ of photosynthesis. Early successional non-sprouting populations were found to be reproductively the most efficient whereas the early successional sprouting populations allocated more to vegetatively reproducing organs. While the high reproductive potential of early successional non-sprouting species is associated with vigour and production efficiency of the species, this relationship is stronger with the latter

