Ecological Farm Practice: A Step towards Sustainable Agriculture

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***Abstract*—** 35 years of 'Green Revolution' in India has created ecological havoc in vast tracts of the country. Intensive rice & wheat cultivation in area like West Bengal *(Eastern India)* was the epicenter and hence is affected most. Over use of chemical fertilizer, pesticides have jeopardized the organic domain of soil thus hampering soil and terrestrial biodiversity. This study projected the significance of ecological farms to sustain diverse ecosystem (terrestrial and soil biodiversity) in compare to chemical intensive farms.

***Keywords*—**Ecological farming, fertilizer, green revolution, organic farming, pesticide.

I. Introduction

ERRATIC use of chemical pesticide has affected the natural pollinator, beneficial insects' populations, and soil macro-fauna in different ways [1-3], [5]. Through last three decades, organic farming movement has made significant strides in India by encouraging use of vermicompost, biopesticide, and integrated farm design. This study was focused on ecological farm designing including the diversification, efficient energy cycling along with input correction.

II. Objectives

The study was directed towards comparing the non cultivated biodiversity parameters such as soil macro fauna, pollinators and non cultivated edible vegetation, between conventional and ecological farms [3], [4]. Another goal of the study was to explore whether farming practice (pesticide and fertilizer input) affected the non cultivated biodiversity [3], [4].

III. Methods

The study was carried out in conventional and ecological farms at Andharmanik (Lat. 22,22.4 N 88, 21.4 E) in West Bengal, India (Bengal and Assam Plain, hot sub-humid to humid eco-region).

A. Soil Macro Fauna

Both the conventional and ecological farms were sampled through Soil Monolith method as per TSBF Protocol. Soil monoliths (25 x 25 x 30 cms) were dissected into 3 layers, namely 0-10 cm, 10-20 cm and 20-30 cm. Soil Macro fauna were then hand sorted from the soil blocks.

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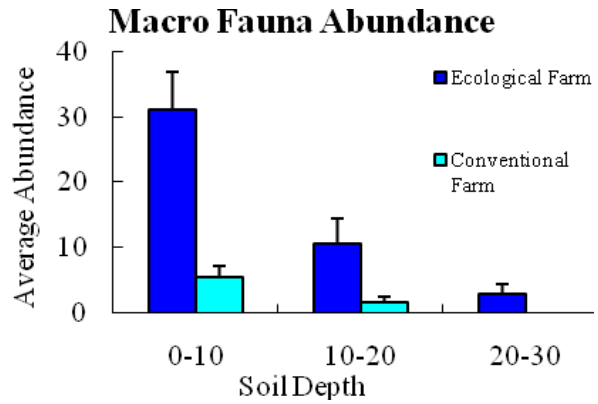

Fig. 1 Macro fauna abundance (average) in the studied area.

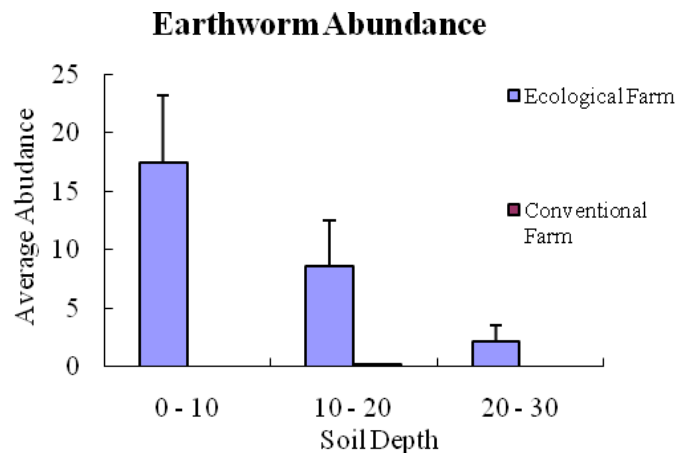

Fig. 2: Earthworm abundance (average) in the studied area.

B. Pollinators

Three ecological Farms were compared with three conventional farms. Farms were about 0.25 to 0.40 acre in size. The conventional farms were sprayed with chemical pesticides *(Thiodon)* prior to observation. Crops in ecological farms were coriander *(Coriandrum sativum)*, onion *(Allium cepa)*, pumpkin *(Cucurbita pepo)*, and pointed gourd *(Trichosanthes dioicia)*. Crops in conventional farms were brinjal *(Solanum melongena)* and pointed gourd *(Trichosanthes diocia)*. Brinjal is self pollinated but cross pollination is known to be beneficial. However, other crops are essentially cross pollinated. Each farm was divided into 4 sites.

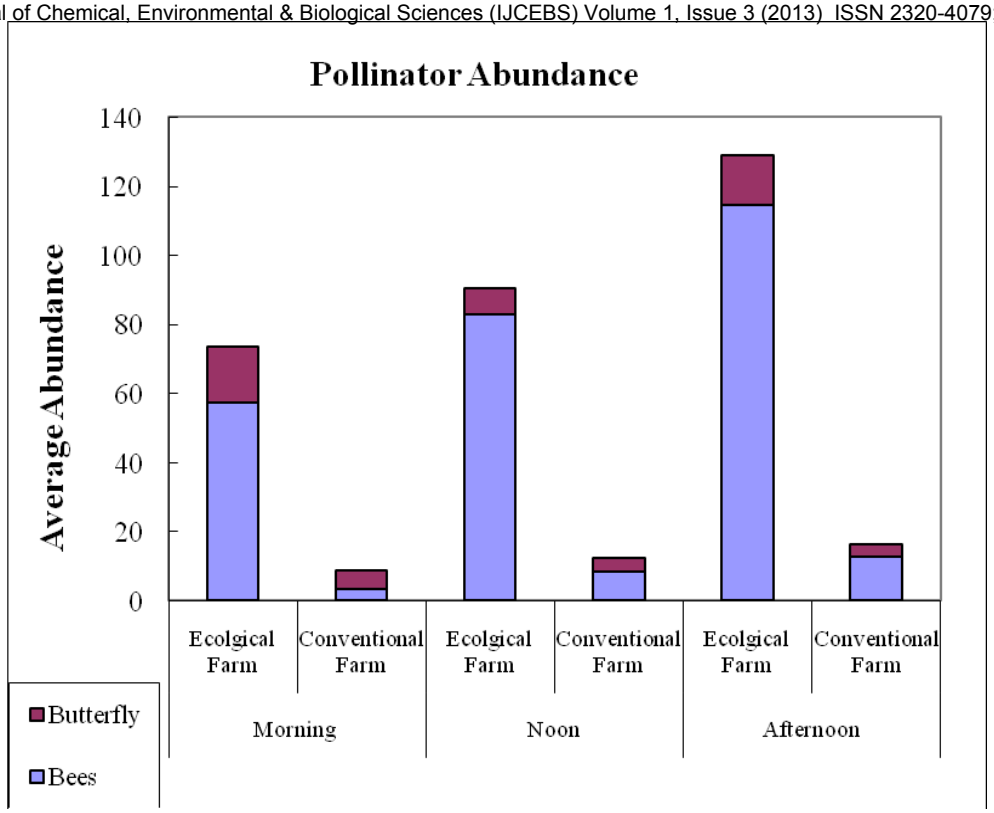

Fig. 3 Pollinator abundance (average) in the studied area.

Each day, a particular site was surveyed in three sessions i.e. morning, noon and afternoon. In each session number of pollinators were recorded for 1.30 hours.

C. Non-cultivated Edible Vegetation

Estimation (Frequency of occurrence) was done while walking along the ecological and conventional farm boundaries. An adjacent fallow that was part of the same farm was also included in the study. A Household survey was conducted among 12 families to determine use of the non cultivated vegetations as food items.

IV. Results and Discussions

Total abundance of soil macro fauna was higher in ecological farms as compared to conventional farms (*Mann Whitney U Test*, $p<0.05$). Earthworm abundance was higher in ecological farms in 0-10 cm as compared to conventional farms. Earthworm was practically absent in all conventional farms except in one. Ecological farms were dominated by earthworm whereas conventional farms were dominated by ants (Fig. 1, 2 and 4).

The use of organic input applications such as vermicomposts, composts, bio-fertilizers etc led to restoration of organic matter pool in soil was the reason for good soil macro fauna population in the ecological farms. These results clearly establish the fact that organic inputs in ecological farms are associated with richer soil macro fauna population such as earthworms, spiders, ants, millipedes, centipedes, beetles, bugs, larvae etc. while they had less abundance in conventional fields.

Ecological farm had more number of pollinators visiting as compared to the conventional farm. More number of pollinators was recorded in the afternoon. Bees were more in

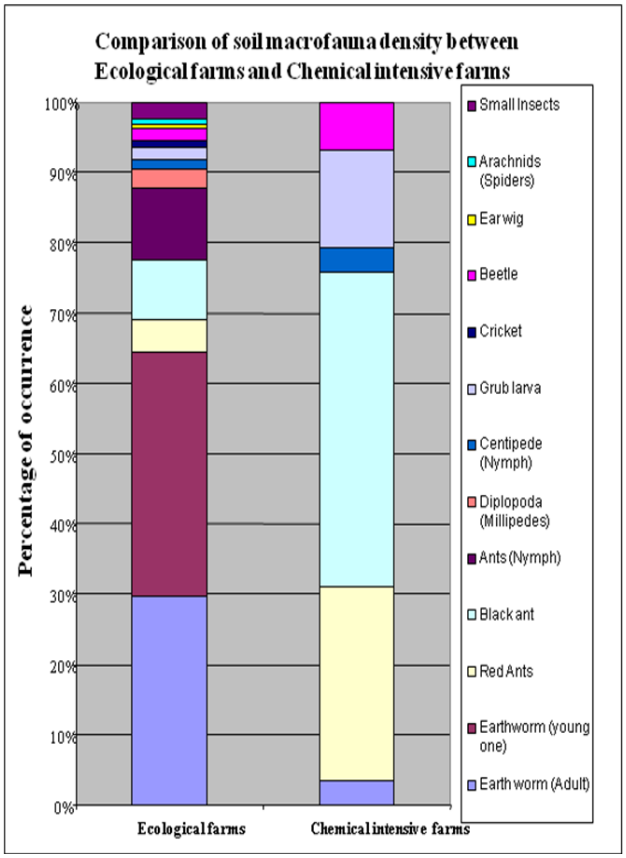

Fig. 4 Comparative study of soil macro fauna density in the studied area.

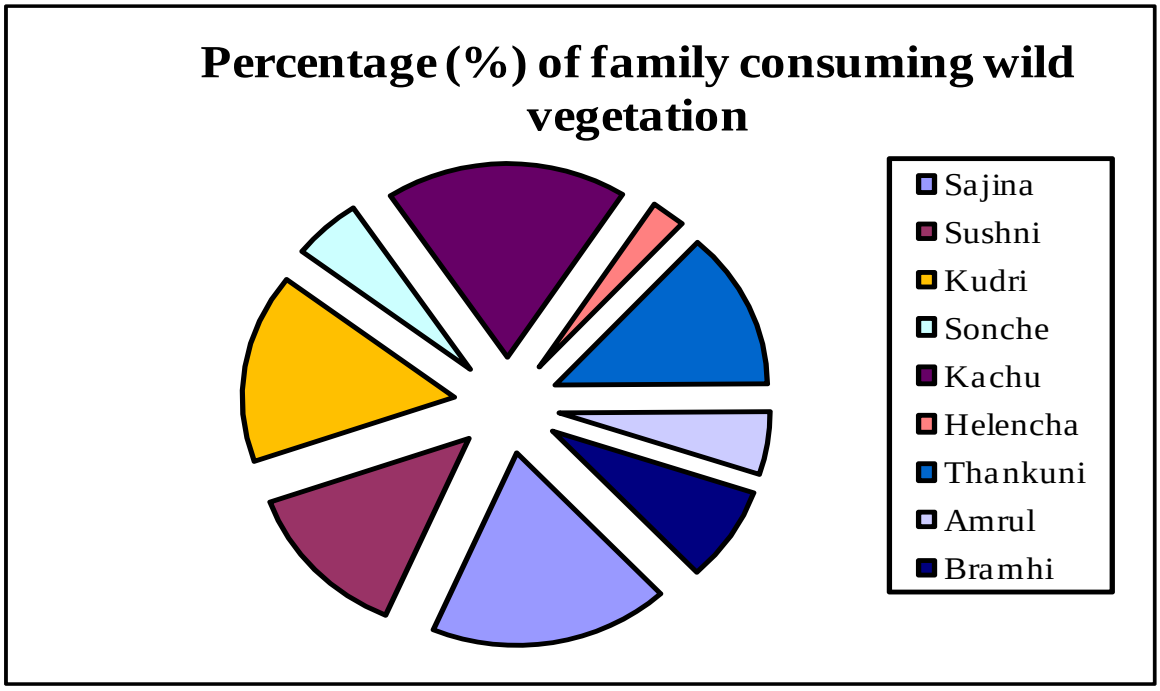

Fig 5 Percentage of family consuming wild vegetation in the studied area.

number compared to butterflies (Fig. 3). Brinjal *(Solanum melongena)* and pointed gourd *(Trichosanthes dioicia)* fields are most heavily sprayed. Natural Pollination has almost ceased in these fields. For pointed gourd, farmers resort to hand pollination.

Non cultivated vegetation is a rich food source for rural households particularly for economically marginal families, Sajina (*M.olifera)* and Kachu *(Colocasia sp.)* are consumed

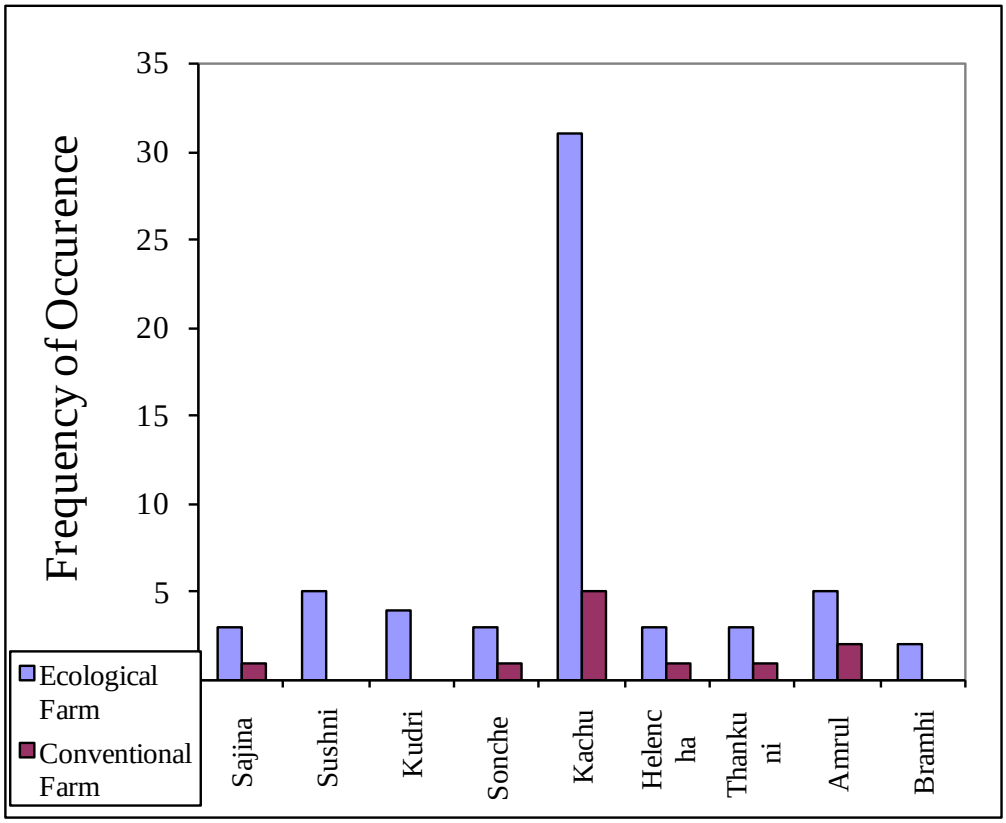

Fig. 6 Frequency of occurrence of wild vegetation in the studied area.

most by the families surveyed (> 55%) followed by Sushni *(Marsilea* sp.*)* and Thankuni *(Centella asiatica)* (Fig. 5). In ecological farms that were studied, these vegetations- mostly herbs, were found to be more diverse around the farm boundaries and were not 'weeded' out. In conventional farms these vegetations were less (Fig. 6).

V. CONCLUSIONS

The study clearly indicates that emphasis on locally available biological resource integration, traditional methods of crop protection and farm designs based agro-ecosystem principles lead to a richer biodiversity in agricultural landscape and of course a more ecologically sustainable agricultural system.

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