CONTRIBUTION FOR IMPROVING THE AGRO-ENVIRONMENTAL EFFICIENCY OF AGROFORESTRY SYSTEMS FOR HONEYBEES IN AGRARIAN ENVIRONMENT

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To cite this version:


HAL Id: hal-01587515

https://hal.archives-ouvertes.fr/hal-01587515

Submitted on 14 Sep 2017

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CONTRIBUTION FOR IMPROVING THE AGRO-ENVIRONMENTAL EFFICIENCY OF AGROFOREST SYSTEMS FOR HONEYBEES IN AGRARIAN ENVIRONMENT

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The importance of a high biodiversity landscape for maintaining honeybees in agrarian environment

Most of the plants cultivated in Europe (84% overall) need pollinators to produce. But since several decades, a decline of the insect pollinators population can be witnessed, and even the extinction of some of them (Vassal et al., 2008). Honeybees are particularly affected by such a loss, and their extinction is increasing, endangering the future of agriculture. An understanding of this multifactorial problem is required.

In this regard, the consequence of the current reduction trend of bellow in agricultural environment is a decrease of the melliferous resources. Therefore, it’s crucial to promote “new” areas of high biodiversity on the edge of cultivated areas in agrarian environment, like hedges, river bank vegetation, or to reintroduce trees in the cropping systems. Such cropping patterns are known as agroforestry systems, and the hypothesis is made that they are able to sustain and even promote beekeeping activities.

Methodology

How useful could be agroforestry for apiculture?

According to IORAF, agroforestry is an integrated approach of using the interactive benefits of combining trees and shrubs with crops and/or livestock. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems.

Trees and crops associations can show several types of combinations (intercropping in copses, windbreak hedges, isolated trees in cultivated fields). On a landscape scale, agroforestry offers complex systems (like hedged farmlands, ensuring even an intensive agriculture highly mechanized but using less chemical inputs. Thanks to the combination between arboretous strata, bushies and grassy strips, agroforestry systems can offer melliferous resources of higher quality and quantity.

Experimental measurements of agroforestry systems’ value, for honeybees

The French Ministry of Agriculture and Fishing is finding a strong interest in agroforestry by supporting an important CASDAR (Comptes d’Affectation Spécifiques pour le Développement Rural Agricoles) development project entitled “Improving the agro-environmental effectiveness of agroforestry systems in agrarian environment”. The aim of this project is to contribute to a better knowledge of agroforestry systems and promote new agroforestry technical routes in order to minimize the impact of intensive agricultural practices on water and soil quality, and on biodiversity. This project is focused on five research topics: “biogeochemical cycle”, “biological life of soil”, “water cycle”, “biomass production”/“regulations”.

Location of the field work areas

Two experimental sites located in Gers, South West of France (showing the same soil and climatic conditions) have been selected. Each of them corresponds to a 3 km radius circle (average distance for a foraging bee). These two sites are 10 km away from each other: the first “experimental” site SE1G1, corresponding to an agroforestry system. The second site SE002; or “control site”, has a similar density of vegetation but a lower plant diversity.

Each site has an apiary of 10 hives belonging to the same beekeeper. Three hives per site are equipped with pollen traps. Three other hives per site are equipped with dead bee traps.

Expected results and outlooks for 2010 and 2011

The implementation of the first year of CASDAR project experimentation ensured us to:
- validate the protocol after having tested all methods developed on the field.
- test the relevance of the first two selected sites
- establish the essential criteria for the selection of 6 other sites planned in addition to those two, to be selected during the first year of experimentation (2009).

So, during 2010 and 2011, experiments will be conducted on 8 sites in order to assess the agroforestry systems value for maintaining honeybees in intensive agrarian environment. The last year (2011) will also be devoted to the data analysis and processing. The results of this initial work will complement a PhD thesis in Geography started in September 2009 and dedicated to the same problematic.

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Work hypothesis

Agroforestry systems promote qualitative and quantitative development of the melliferous resources

Agroforestry systems promote the availability and durability of the melliferous resources at the landscape level in term of quality and spatial scattering.

Types of observation (March to October)

Objects Features
Beekeping monitoring • Weighting hives (1 time a month) • Counting the dead bees (2 times a week) • Measurements of brood (1 time a month)
Pollinical monitoring • Pollen harvest (2 times a week) • Pollen analysis in laboratory
Foraging observation • Foragers enumeration using the transect method for the herbaceous strata and the 100 flowers method for the arboretous strata (1 time a week)
Meteorological data • Pluvimetry, Temperatures, Wind
Botanical inventory of all sites • Melliferous resources typology. • Blooms monitoring on each site from March to October, for 2 years.
Mapping the agrarian land use and cover • Location and grassland areas measurements (follow land, grasslands, hayfields ...), hedges, copses, building areas, gardens, using the a GIS software (Geographical Information System)