Osservatorio Nazionale del Miele - 31 Marzo 2021

SALUTE DELLE API ED APICOLTURA SOSTENIBILE
BEE HEALTH AND SUSTAINABLE BEEKEEPING

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AGRICULTURE & INNOVATION

funded by European Commission

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Taking into account bees "well-being" (comfort) in production

Final report: 44 pages

Minipaper 03: 8 pages

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Sept. 2020

+ results from research programme

Initial issues

What are the **criteria** for defining the **well-being** of a colony?

- Hypothesis 1: Well-being is correlated with **resilience**
- Hypothesis 2: Practices closest to natural adaptation (Darwinian principle) increase resilience

Taking into account bees natural living conditions in production

Goals of the Focus Group

- **Specific approach**
- Apply the principles of "**agroecology"** to beekeeping

> **Minimize** differences between conditions of **man-managed** honeybee colonies and **evolutionary adaptation** environment

> Integrate in **beekeeping practices** as much as possible the **natural living conditions of bees** while **being productive for beekeepers**

"colonies first" **production needs**

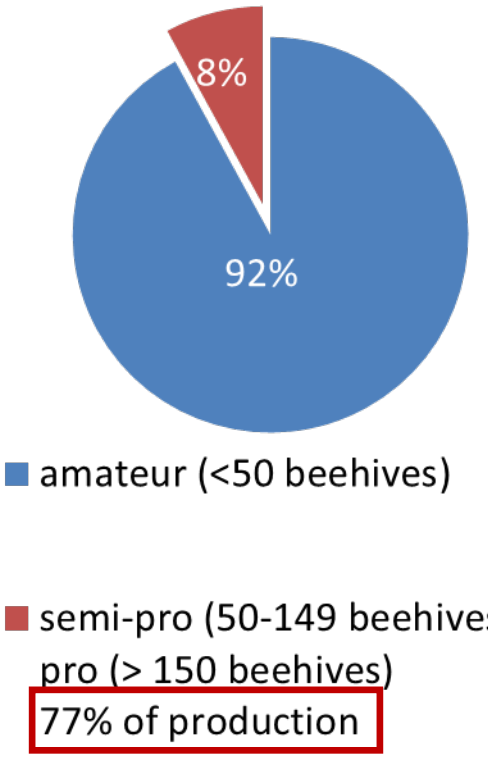
3 sources of motivations

- **Society**
- Ethical consideration of **animal welfare** in animal production

- **Professional beekeepers**
- Current **critical** context for bees survival
- **Consider changes** in their practices

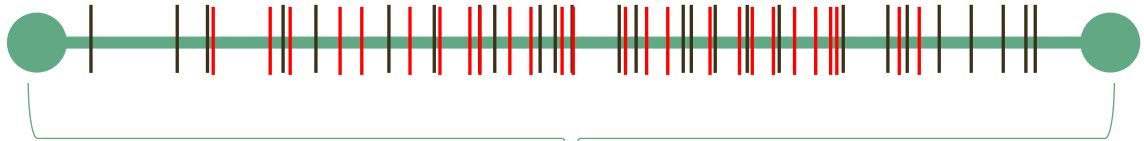
- **Amateur beekeepers**
- **Do not depend on** their hives for production and income
- Looking **for extensive beekeeping practices**
- **Growing** number

57000 of beekeepers (France, 2018)



Issues

How to guide bekeepers **closer to the natural** living conditions of bees on their farms while **remaining productive**?



"colonies first" **production needs**

660 000 European beefarms

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Our methodology

- **From the literature**: **Stress** on which **beekeepers** can provide opportunities for intervention at their **apiary levels**

Ex.

Stress factors	Risks for bees resilience	Natural (Darwinian) beekeeping	Organic beekeeping
Diseases and biological agents	¤	-Monitor·and·control·*Varroa*.·¶ -Remove·colonies·with·high·infestation·rates·to·limit·the·spread·of·*Varroa*·mites¤	-Organic·acid·varroacides, mechanical·and·thermal·methods·only·¶ -Diligent·diagnosis·of·infestation¤
Apiary management	-Competition·for·foraging, reproductive·problems, transmission·of·pathogens·and·parasites.·¶ ¤	-Create·small·apiaries·(depending·on·the·local·conditions)·(ex:·no·more·than·10·colonies)·¤	-Standards·limiting·the·number·of·bee·colonies·in·apiary¤
Beehive construction and location	-Limitation·of·swarming¶ -Energy·cost·of·colony·thermore·(hive·insulation)·and·stress·for·t·keep·up·with·favourable·interna·hygrothermal·climate¶ -Antibacterial·action·of·the·chem·properties·of·the·hive·building·m·(limitation·of·the·rate·of·infestat·the·*Varroa*·parasite·and·micro-organisms)¤	See Annex for detailed results	·aterial·(wood·or·polystyrene·only·for·nucleis), no··rotection, no·varnish, regular·disinfection·of·hive··t·and·steam·only·¶ ·of·wood: not·planed·for·safehousing·beneficial··era),·¶ ensuring·that·bees·can·properly·manage·the·internal··re·(good·ventilation·management)¤
Brood and colony management	-·Natural·selection·hampering·(via·drones·gene)·↵ -·Thermoregulation·and·queen·egg·laying·hampering·¶ ¤	¤	-Keeping·up·genetic·diversity, based·on·swarm·drive·¶ -Possibility·of·having·a·broodless·period·linked·to·swarming·¤
Colony genetics selection	-·Reduction·of·queen·lifetime, ·disruption·of·natural·choice·of·patrilines·by·bees·themselves, ·unadaptation·to·geographical·locations¤ ¶	-Locally·adapted·genetics¶ -Selections·of·bee·colonies·according·to·vitality·traits.·¤	-Preference·for·*Apis mellifera mellifera*·and·its·ecotypes·premises·¶ -Obligation·to·buy·organic·queens·and·swarms·(max.·10%·of·non-organic·swarms)·¶ ¤
Honey and pollen harvest	-·Reduction·of·worker·bees'·quality¤ ¶	Limit·the·harvest·(1·to·2·kg·honey·per·hive)¤	-Leave·honey·in·sufficient·proportion·for·the·winter·provisions·¶ -Organic·honey·or·sugar·only¤
Migratory beekeeping	-Troubles·on·colony·weight·gain·evolution, pathogen·and·parasite·transmission¤ ¶	-Avoid·relocation·of·hives·only·to·local·and·regional·migrations¤	-Any·relocation·of·apiaries·requires·information·with·the·certifying·body·¶ -No·migration·to·conventional·crops·for·harvest·or·hive·products·downgraded¤
Wax management	-·Energetic·burden·to·produce·wax, ·chemical·remaining·in·wax·from·unknown·origin¤	Avoid·using·wax·from·unknown·origin¤	-Frequent·removal·of·old·combs·(progressive·renewal·of·body·waxes·over·3·to·5·years)·with·organic·wax·¶ -Recycling·of·virgin·wax·only·¶ -Wax·processing·with·heat·only, no·solvents¤

Example of one stress factor: Beehive construction and location

How to guide bekeepers **closer to the natural** living conditions of bees on their farms while **remaining productive**?

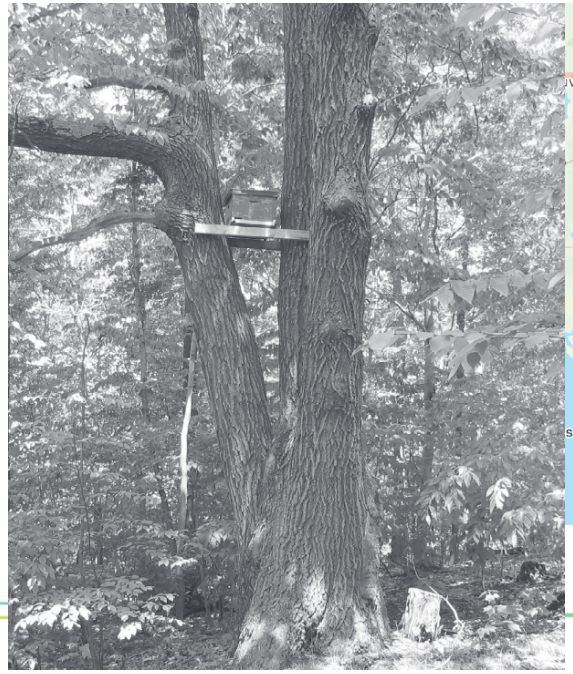
=

How to help beekeepers to develop **beehives and practices around** closer to the natural living conditions while allowing harvest, migratory, economic constraints .....?

What are honeybees natural living conditions?

Dream home for honeybees **T. Seeley (2010, US)**

- Nest entrance height above the ground: high entrance, 5 m
- Size of entrance to the nest: small entrance, 12.5 cm^2
- Space of the cavity: spacious cavity, 40 litres
- Entrance direction: south
- Cavity dryness: the honeybees can remove wet substance and waterproof a leaky cavity
- Cavity draftiness: honeybees can caulk cracks and holes with propolis



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From associations, craftsmen, etc.

"colonies first"

production needs

Biomimetism for beehives

Une ruche refuge c'est quoi ?

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Sources: ask anna.dupleix@umontpellier.fr

Diversity of beehives over times and practices

Beekeeping practices	« Hunter-gatherer »	« Traditional » « handcrafted »	« Modern » « Productive » « Industrial »	« Biodiversity » « Shelter »
Beehive types	No beehive Natural sites (hollow trees, cliffs)	Various shapes made from locally available materials	Square wooden hive with movable frames and possible enlargement	Newly developed shapes and materials to imitate nature

Models locally adapted

- Dadant,
- Langstroth,
- Voirnot,
- Deutsche normal,
- Warré,
- Alsacienne

Source : inspired from Adam, A. (2019

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Current issues related to the hive

How to measure that a hive provides a habitat close to the local natural living conditions (assumed to be optimal)?

- Need for :

 - criteria to characterise quantitatively the beehive habitat
 - measurement tools easy to implement
 - interpretation tools for beekeepers to act

Most manufacturers sell temperature sensors as an objective way to measure the health of a colony within the hive

Hive Health and Production Monitoring ModuSense

Monitor hive health Hivemind™ We have been working closely with industry leaders to provide Beehive Health Monitoring solutions

Help your bees thrive. By monitoring apiary health, you can take action to improve your bees' general health so they're able to focus on building their hive. Hives that are struggling and require intervention are quickly identified, minimising loss of bees.

The **BuzzBox Mini** is your smart hive monitoring assistant. We use artificial intelligence to inspect your hive's health and report updates to your mobile

osbeehives

Much as EKGs help doctors better understand the stresses of their patients, our equipment reveals the health metrics of bee hives. This allows the beekeeper to make hive adjustments based on facts, not hunches. **BROODMINDER**

All the data gathered from these sensors are used by our algorithms to understand your hives and send you suggested actions for improved colony health. ApisProtect

arnia remote hive monitoring Better Knowledge for Bee Health

Our User Interface enables you to directly compare data from multiple sensors to provide a level of insight into colony health and behaviour that is otherwise unattainable.

Using **Beebot** you are joining the era of digital beekeeping by collecting valuable data, easily accessing it from anywhere on any device and even sharing with advisors and customers. Bee smart and keep healthy bees with **Beebot**! pollenity

Brood chamber temp. sensor wolfwaagen von Imkern für Imker

What about the bee`s health? Profit from the sensors brood chamber temperature measurement. It gives you indication on the health and breeding activities of the bees.

nectar

Raise healthier bees

Make more informed decisions leading to lower mortality and higher frame counts.

Les données, collectées toutes les heures par les capteurs, sont consultables via une application dédiée. Hygrométrie, température... ces informations offrent la possibilité de connaître rapidement l'état de santé de l'essaim d'abeilles hostabee

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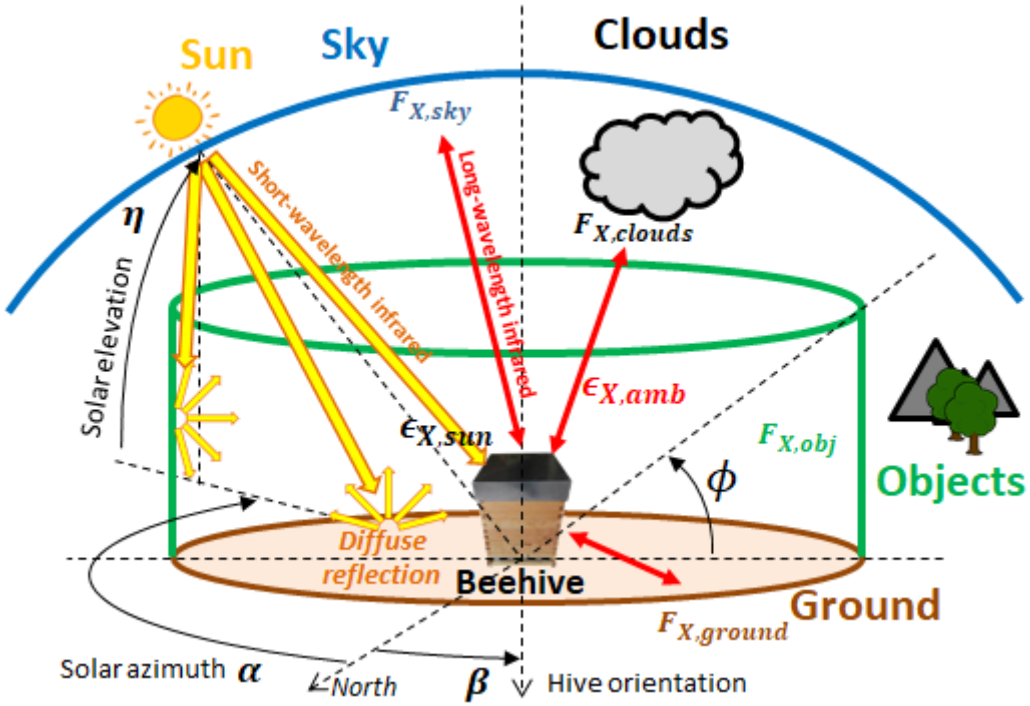
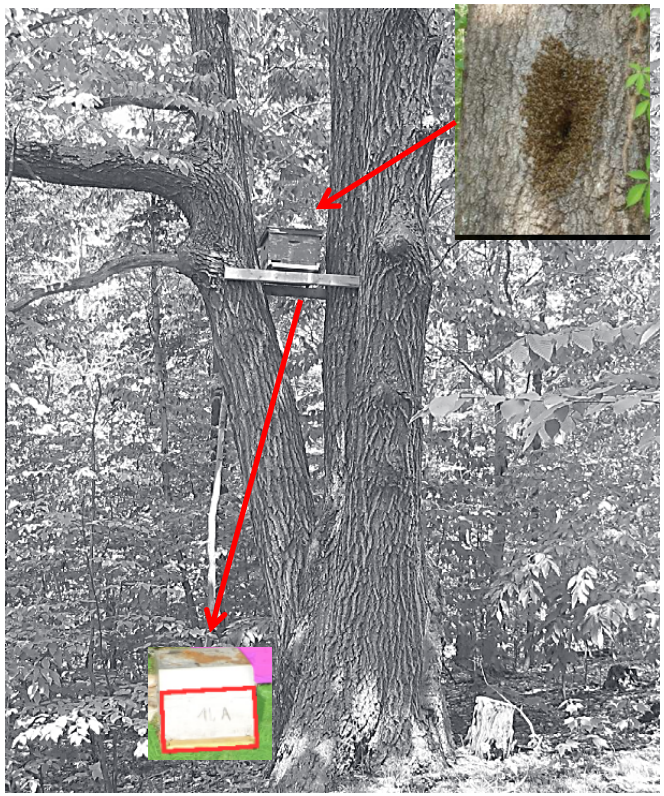
Measuring the in-hive temperature is dependent on the environment





Simple **in-hive temperature** is the **sum of a set** of **environment factors**

Need **beehive thermal modelisation**

For more information (Cari Conference, 07/01/2021)

https://www.researchgate.net/publication/348579012_Temperature_et_isolation_des_ruches

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Conclusion

- Work done in **each bee farms** (to a certain extent)
- **Solutions** tools to actual bees problems

Conjugating production and bees « well-being » within the bee farm
=
Needs for innovation

- Assess quantitatively the **impact** of **each stress factor** on the **bees well being**
- Offer **decision-making tool** for beekeepers

Give beekeepers quantitative data to make an **informed choice of**

Avoid polarization on "a truth" - which would oppose good and bad approaches to beekeeping

Merci à vous!

Grazie a voi!

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Annex

Stress factors	Risks for the well-being of bees	Solutions in terms of Darwinian beekeeping practices	Solutions in terms of organic beekeeping practices
Diseases and biological agents - *Varroa* - Effect of microorganisms (fungi, bacteria, virus)		-Monitor and control *Varroa*. -Remove colonies with high infestation rates to limit the spread of *Varroa* mites	-Organic acid varroacides, mechanical and thermal methods only -Diligent diagnosis of infestation
Apiary management - Spacing of the colonies	-Competition for foraging, reproductive problems, transmission of pathogens and parasites.	-Create small apiaries (depending on the local conditions) (ex: no more than 10 colonies)	-Standards limiting the number of bee colonies in apiary
Beehive construction and location - Geometry, volume and architecture - Beehive wall thickness - Timber building material	-Limitation of swarming -Energy cost of colony thermoregulation (hive insulation) and stress for bees to keep up with favourable internal hygrothermal climate -Antibacterial action of the chemical properties of the hive building material (limitation of the rate of infestation by the Varroa parasite and micro-organisms)	-Hive structure (geometry, building material, wall thickness) reproducing the parameters naturally chosen by wild domestic colonies in nature (natural nest). - Choose appropriate hive location (shadow, safe from disturbers and hazards from agriculture) and beehive vertical position -Provide uncontaminated water source -Use movable boards	-From natural material (wood or polystyrene only for nucleis), no chemical wood protection, no varnish, regular disinfection of hive material with heat and steam only -Interior surface of wood: not planed for safehousing beneficial organisms (chelifera), - Beehive shape ensuring that bees can properly manage the internal climate of the hive (good ventilation management)
Brood and colony management - Drone brood removal - Brood nest disruption	- Natural selection hampering (via drones gene) - Thermoregulation and queen egg laying hampering		-Keeping up genetic diversity, based on swarm drive -Possibility of having a broodless period linked to swarming
Colony genetics selection - Queen shipping and trade - Rearing of queens on selected eggs	- Reduction of queen lifetime, disruption of natural choice of patrilines by bees themselves, unadaptation to geographical locations	-Locally adapted genetics -Selections of bee colonies according to vitality traits.	-Preference for *Apis mellifera mellifera* and its ecotypes premises -Obligation to buy organic queens and swarms (max. 10% of non-organic swarms)
Honey and pollen harvest - Compensating artificial diets	- Reduction of worker bees' quality	Limit the harvest (1 to 2 kg honey per hive)	-Leave honey in sufficient proportion for the winter provisions -Organic honey or sugar only
Migratory beekeeping - Relocations for honey harvest	-Troubles on colony weight gain evolution, pathogen and parasite transmission	-Avoid relocation of hives only to local and regional migrations	-Any relocation of apiaries requires information with the certifying body -No migration to conventional crops for harvest or hive products downgraded
Wax management - Wax removal and replacement	- Energetic burden to produce wax, chemical remaining in wax from unknown origin	Avoid using wax from unknown origin	-Frequent removal of old combs (progressive renewal of body waxes over 3 to 5 years) with organic wax -Recycling of virgin wax only -Wax processing with heat only, no solvents

Natural tree hIve	Tree Hive	Common Aplary
High off the ground 4-8m, where the humidity is lower, and it is warmer in winter	4m above the ground, where the humidity is lower and it is warmer in winter	Very close to the ground
Small nest (40 ltrs median volume)	Large nest (80 ltrs volume)	Large nest (70+ ltrs volume)
Small hive opening	Small hive opening	Large hive opening
Thick hive walls covered in propolis	Thick hive walls covered in propolis	Thin wooden floor and walls. Propolis removed and floor cleaned at least annually
Queens live long on small brood comb (1m2)	Queens live long on small brood comb	Queens often replaced by beekeeper (1-2 year cycle) on large brood comb (2 m2)
Hives well spaced (1-3 hives per km2)	Hives well space (1-3 hives per km2)	Hives closely packed together
Regular annual swarming	Regular annual swarming	Swarm prevention
Brood nest not restricted and follows the bee preference (17% drones)	Brood nest not restricted and follows the bee preference	Brood nests often culled to remove or restricted to reduce drones
No chemical or antibiotic treatments	No chemical or antibiotic treatments	Regular chemical treatments for mites and common diseases
No honey harvest	Limited honey harvest	Extensive honey harvest
No opening of hive	Hive opened twice a year: Spring check and then September Harvest	Regular opening of hive, sometimes weekly
Bees never fed sugar	Bees never fed sugar	Bees routinely fed sugar
Hive consists of empty cavity	Spales added to support comb during harvesting	Frames for easy honey removal and transfer of combs and brood (and pathogens!) between hives
No intervention to prevent loss	No intervention to prevent loss	Intervention to prevent loss
		Sometimes migratory