APPENDICES

LIST OF APPENDICES

[1] That is, the level of harmfulness coupled with the level of exposure to these products (cf. Glossary).

APPENDIX 1

List of active ingredients used in pesticides that are banned by international conventions

The following conventions are in place:
- **The Stockholm Convention:** the POP list “Persistent Organic Pollutants” dated 2006.
- **The Rotterdam Convention:** the PIC list "Prior Informed Consent" from 2004 and initiated by the United Nations Environment Programme.
- The **PAN 12 list,** dating back to 2011 including a list of the 18 most hazardous compounds used in agriculture.
- **The WHO lists WHO 1a and WHO 1b:** These two lists classify extremely hazardous compounds (1a) and highly hazardous (1b) to health. It was established by the WHO, the World Health Organization. It dates back to 2007.
- The **Montreal Protocol**, dating back to 1987 for the protection of the ozone layer.

Substances prohibited by international conventions	POP	PCP	PIC	WHO 1a	WHO 1b	Montreal Protocol
1,2 dibromethane (ethylene dibromide) (EDB)		x	x			
1,2 dichloroethane (ethylene dichloride)		x				
2,4,5-T (2,4,5 trichlorophenoxyacetic acid) and its salts and esters (dioxin contamination)		x	x			
3-chloro-1,2-propanediol (Alpha-chlorohydrin)					x	
phenylmercury acetate (PMA)				x		
copper aceto-arsenite (Paris green)					x	
acrolein					x	
allyl alcohol					x	
aldicarb			x	x		
aldrin	x	x	x			
alpha HCH (alpha-hexachlorocyclohexane)	x					
asbestos (such as crocidolite, actinote, antho-phyllite, amosite and tremolite)		x				
lead arsenate					x	
calcium arsenate					x	
sodium arsenite					x	
azinphos-ethyl					x	
azinphos-methyl	x				x	
beta-cyfluthrin					x	
beta HCH (beta-hexachlorocyclohexane)	x					
binapacryl		x				
blasticidin-S					x	
brodifacoum				x		
bromadiolone				x		
bromethalin				x		
methyl bromid						x
butocarboxim					x	
butoxycarboxim					x	
cadusafos (ebufos)					x	
captafol		x		x		
carbofuran					x	
chlordane	x	x	x			
chlordecone (Kepone)	x					
chlordimeform		x	x			
chlorethoxyfos				x		
chlorfenvinphos					x	
chlormephos				x		
chlorobenzilate		x				
chlorophacinone				x		
mercury chloride		x		x		
mercury and its compounds (mercury oxide, mercury chloride (calomel), phenylmercury acetate (PMA), oleate, phenylmercuric (PMO), alkyl mercury, alkyloxyalkyl and aryl mercury compounds)		x				
coumaphos					x	
coumatetralyl					x	
calcium cyanide				x		
sodium cyanide					x	
cyfluthrin					x	
DBCP (dibromochloropropane)			x			
DDT (dichlorodiphenyldichloroethylene)	x	x	x			
demeton-S-methyl					x	
dichlorvos					x	
Dicrotophos					x	
dieldrin	x	x	x			
difenacoum				x		
difethialone				x		
dinoseb (acetate and salts)		x				
dinoterbe					x	
diphacinone				x		

disulfoton				x		
DNOC and salt (ammonium, potassium, sodium)		x			x	
polychlorinated biphenyls/PCBs (except mono and bichlorinated)(Aroclor)	x	x				
Dustable powder						
edifenphos (EDDP)					x	
endosulfan	x					
endrin	x		x			
EPN				x		
ethiofencarb					x	
ethoprophos (Ethoprop)				x		
famphur					x	
fenamiphos					x	
flocoumafen				x		
flucythrinate					x	
fluoroacetamide		x			x	
sodium fluoroacetate (1080)				x		
formetanate					x	
furathiocarb					x	
heptachlore	x	x	x			
heptenophos					x	
hexachlorobenzene (HCB) (benzene hexa-chloride)	x	x		x		
hexachlorocyclohexane mixture of isomers		x				
hexachlorocyclohexane HCH/BCH	x		x			
isoxathion					x	
lindane (gamma-HCH)	x	x	x			
mecharbam					x	
bolybrominated biphenyl mixture (com-pound) (PBB)		x				
methamidophos		x			x	
methidathion					x	
methiocarb (mercaptodimethur)					x	
methomyl					x	
methylparathion		x	x	x		
mevinphos				x		

mirex	x					
monocrotophos		x			x	
nicotine					x	
omethoate					x	
oxamyl					x	
ethylene oxide (oxirane)		x				
mercury oxide		x			x	
oxydemeton-methyl					x	
paraquat		x				
parathion		x	x	x		
pentachlorobenzene	x					
pentachlorophenol (PCP), its salts and esters		x	x		x	
phorate				x		
phosphamidon		x		x		
zinc phosphide					x	
phostebupirim				x		
tetraethyl lead		x				
tetramethyl lead		x				
propetamphos					x	
strychnine					x	
thallium sulfate					x	
sulfotep				x		
tebupirimfos (phostebupirim)				x		
tefluthrin					x	
terbufos				x		
thiofanox					x	
thiometon					x	
toxaphene	x	x	x			
triazophos					x	
polychlorinated triphenytes (PCT)		x				
tris-phosphate (2,3-dibromopropyle)		x				
vamidothion					x	
warfarin (coumaphene)					x	
zeta-cypermethrin					x	

APPENDIX 2

Village survey guides on management of pesticides and their alternatives

Listing of agricultural pesticides found in the villages and, for each of them, active ingredients and primary uses

Commercial names	Product active ingredients	Pesticide type[65]	Crops concerned

How these pesticides are to be used (with or without boots, gloves, suits and masks, whether or not the wind is taken into account, frequency of treatments without any precautions)

Health incidents documented in the villages surveyed

[65] Herbicides, fungicides, insecticides*(NB: Acaricides and nematicides will be classified with insecticides)*

Examples of alternatives known to some farmers that do not (only) use these chemical pesticides (for each alternative, ease and frequency of application)

APPENDIX 3

Overview of surveys on the mode of management of pesticides in 3 villages in Kita Cercle, Mali

Surveys conducted by Sékou Traoré, member of UR-CUMA 09/29/2018

Last name and first name of farmer surveyed And village	Where are the containers stored	If locally, are they locked?	What must be worn for specific treatments (clothes, footwear, gloves)?	After treatment, where is the outfit kept?	Who washes the clothing and footwear?	How does the person who performed the application wash him or herself?
Django Keita Dougoura-coroni	Location near the house for full drums Village store for empty drums	Yes Yes	Personal clothing used Neither gloves nor a masque (only in the presence of dust) Closed footwear	Location on the field or in a tree	Himself	Bathing at the waterhole and then shower at home
Abdoulaye Keita Dougoura-coroni	Location on the field for full drums Village store for empty drums	Yes Yes	Full-body suit, boots and gloves obtained from WTDC	Location on the field or in a tree	Himself	Bathing at the waterhole and then shower at home
Mahamadou Kéita Kolondi	Full containers kept at home Empty containers discarded on the field	Yes	Personal clothing used Neither gloves nor a masque (only in the presence of dust) Closed footwear	Location on the field or in a tree	His wife	Bathing at the waterhole and then shower at home
Mamadou Kéita Kolondi	Full containers kept at home Empty containers buried on the field	Yes	Personal clothing used Neither gloves nor a masque (only in the presence of dust) Closed footwear	On a tree in the field	Himself	Bathing at the waterhole and then shower at home
Tiemoko Kéita Kolondi and 3 surveys at Siranikoro	Full containers kept at home Empty containers burned on the field	Yes	Personal clothing used Neither gloves nor a masque (only in the presence of dust) Closed footwear	On a tree in the field	Himself	Bathing at the waterhole and then shower at home
Fadiala Kéita **Siranikoro**	Full containers kept at home Empty containers burned on the field	Yes	Personal clothing used Neither gloves nor a masque (only in the presence of dust) Closed footwear	On a tree in the field	Himself	No watering hole. He goes straight home to wash.

Appendix 4

Information collection guide on natural preparations used in villages in crop production.

[document based on the work of asproPNPP]

Document for each preparation

Name of the preparation:
Crops:
Objectives of the preparation:

Primary materials used:

- Name of the plants
- Date of harvest of the plants used and time of harvest (morning, evening etc.)
- Place where the plants used were harvested
- Indicate the part of the plant used (leaf, root, wood etc.)
- ☐ Fresh plant ☐ Dry plant

Description of the different steps of the procedure, specifying if necessary:

- The container(s) used (size and material)
- Solvent(s) used or any other ingredients added (quantity and time when added)
- If the preparation is obtained through soaking, specify means for determining the total duration of this step. This time can be described according to the criterion(ia) obtained by the operator (e.g.: time, visual characteristic, odor, physicochemical parameters of the solution, others;)
- If the process involves a heating step, specify the means used to evaluate the temperature of the preparation and the heating time (e.g. visual characteristic, smell, physico-chemical parameters of the solution, time, other temperatures);
- If a filtration step is required, describe the filtration process;
- If a distillation step is required, describe the distillation process;

Packaging of the preparation:

Storage condition and storage time before application

Application

- Application date:
- Crop stage:
- Crop condition:
- If water is added, specify the quantities:
- Does the preparation need to be mixed before use:
- How much preparation for the respective field size?
- Specify the time and weather conditions for application
- Which part of the plant or field is the preparation is applied to?

APPENDIX 5
Guide for the collection of ethnoveterinary practices.

Proposal based on the veterinary thesis work of François RUAUD in Madagascar in 2018[66]. This guide is based on the "ethnoveterinary question list" protocol (Grandin and Young 2001) which recommends first collecting information on the farm environment: understanding the farming system and targeting the species raised; then establishing a list of diseases encountered by the farmers. The second step involves addressing a list of questions (see the tables below) regarding a given pathology and its associated treatment and to repeat this list as many times as necessary.

a) survey questionnaire

N°: Date: District: Duration of interview:
First and last name: Community: Fonkontany:
Sex: Locality: Agroecological zone:
Age: Number of persons involved: Contact:
Ethnicity: Primary activity: Secondary activity:
Literacy: Health workers:

Animals bred	**Cattle**	**Goats**	**Sheep**	**Pigs**	**Poultry**
Species/ breeds					
Housing					
Feeding					
Primary diseases/ symptoms (underlined if a traditional treatment exists)					
Tick prevention					

[66] RUAUD, F. (2018). "Etude ethnovétérinaire des pratiques thérapeutiques et préventives d'éleveurs du Sud de Madagascar" (Ethnoveterinary study of therapeutic and preventive practices of livestock farmers in Southern Madagascar) (Androy and Anosy regions), doctoral thesis, Faculty of Medicine of Nantes, Oniris: Ecole Nationale Vétérinaire, Agroalimentaire et de L'alimentation Nantes Atlantique (Nantes-Atlantic National College of Veterinary Medicine, Food Science and Engineering), 316 p.

PATHOLOGY DOCUMENT

Disease name(s)			
Specie(s) affected			
Age category			
Seasonality			
Contagiousness			
Favoring factor			
Symptoms			
Duration of progression			
Progression without treatment			
Disease prevention			

MEDICINAL PREPARATION FORM

Name of the preparation Preventive/curative			
Introduction method			
Procurement method (cost)			
Dosage			
Frequency			
Duration			
Toxicity			
Source of knowledge			
Other targeted diseases			
Conservation			
Assessment of effectiveness			
Conventional treatment (yes/no), cost and selection			

DISCUSSION REGARDING TRADITIONAL VS CONVENTIONAL MEDICINE

Disease name(s)		
Traditional medicine (plant-based treatment)		
Conventional medicine (synthetic drugs, vaccines...)		

b) List of questions to address to complete the pathology and medicinal preparation tables

1/ Which diseases (or clinical signs) are frequently observed in breeding?
Response objectives: list of diseases/syndromes by species.

2/ For which diseases do you know of traditional remedies?

3/ To assess each disease: list of questions for each disease:
- What is (are) the local name(s) given to the disease/syndrome?
- Which animals are affected?
- Are the young animals affected? Are the adults affected?
- When (at what time of year) does the disease appear?
- Are all the animals affected at the same time? (of 10 animals, how many are affected at the same time?)
- Are you aware of one or more factors that promote the emergence of the disease?
- How do you recognize the disease (symptoms)?
- How long does it take for the disease to develop?
- What happens if nothing is done? (Death or healing?)
- What can be done to prevent the disease from emerging?

4/ The following list of questions provides details on the treatment:
- What is the local name for the medical preparation?
- How do you obtain the treatment (self-prepared, traditional practitioner, veterinary assistant, veterinarian, market)

➡ If self-prepared:
- What are the preparation ingredients?
- How do you prepare the treatment?
- What dose do you administer, how often and how long does treatment take?
- Is there a risk of toxicity and how do side effects manifest themselves?
- Who taught you the recipe (family heritage, traditional practitioner, advice from another livestock farmer, veterinarian, assistant...)
- Is this treatment also effective against other diseases?
- Can this treatment be conserved, if so how?
- Do you find this treatment effective? (does it offer an effective cure? Of 10 diseased animals, how many heal?)

➡ If the treatment is provided by a third party
- Who applies the treatment?
- How much does the treatment cost?
- What dose do you give, how often and how long does treatment take?
- Do you follow the advice given (dosage and duration)?
- Do you conserve the treatment for future use?
- Do you know of a synthetic veterinary medication that would be effective for treating the disease?
- What does it cost?
- Why do you prefer the traditional treatment?

5/ Do you use traditional medicinal preparations to fight external parasites (in particular, ticks)?

6/ Do you know of other plants that could be used to treat the animals?

APPENDIX 6

List of studies on ethno-veterinary practices carried out within the scope of AVSF's activities.

Country	Date	Author/ articling student - contact	Document type	Practical tool/developed land Document available	Direct links to online documents when available
World	2004	Baldomero Molina Flores		Reasoned bibliographical review (doc. in English, Spanish and French)	
Mali		Marc Chapon		Excel table summarizing some traditional practices in northern Mali	
Brazil	2009	Emmanuel Bayle		Guide written in Portuguese on the use of medicinal plants on livestock in Brazil (Uso das plantas medicinais na criação animal)	https://fr.scribd.com/doc/124567746/USO-DAS-PLANTAS-MEDICINAIS-NA-CRIACAO-ANIMAL
Columbia Equateur	2012	Amélie Cornillet	Vet thesis	Booklet "CONOCIMIENTO ANCESTRAL INDÍGENA EN SALUD ANIMAL" 50-page booklet on key remedies in dairy farming referenced in Appendix 2 of the thesis + field trial results (to be recovered)	http://kentika.oniris-nantes.fr/ListRecordVisio.htm?idlist=5&record=19283937124910011199 https://www.avsf.org/fr/posts/1678/full/conocimiento-ancestral-indigena-en-salud-animal-en-el-territorio-de-los-pastos-colombia
Togo	2014	ITRA Stefano/ Adom Aliti		Table summarizing some traditional recipes in Northern Togo (ITRA)	
Cambodia	2013-2014	Victoire Delesalle	Vet thesis	Use of medicinal plants in chicken, pig, cattle and buffalo farmings in Cambodia	http://theses.vet-alfort.fr/telecharger.php?id=2114
Equateur	2015	Fanny Parenton	Vet thesis	Practical guide (draft) "Guía práctica para la crianza agroecológica de los especies minores"	http://oatao.univ-toulouse.fr/13339/1/Parenton_13339.pdf
Guatemala	2017	Sophie Polydor	Vet thesis	Practical guide for farming families and agro-veterinary promoters – 22p (Appendix 6)	http://oatao.univ-toulouse.fr/17632/
Bolivia	2017	Richard Labone	Vet thesis	Manual de Etnoveterinaria en la crianza camélida (in Spanish) Guía de medicina natural para las llamas	https://www.avsf.org/fr/posts/2118/full/manual-de-etnoveterinaria-en-la-crianza-camelida-en-bolivia http://kentika.oniris-nantes.fr/GED_BHV/194460291264/na_15_127.pdf
Madagascar	2018	François Ruaud	Vet thesis	No	http://kentika.oniris-nantes.fr/ListRecordVisio.htm?idlist=2&record=19317943124911351259
Columbia	2020	Marine BENOIT and Adrien DEMILLY	Voluntary service (6 months) for the ECOPAZ project	Dissertation "Inventaire des pratiques thérapeutiques traditionnelles et mise en place de mesure de lutte contre les mammites de la vache laitière dans la région de Pasto – Nariño – Colombie" (Analysis of traditional therapeutic practices and implementation of measures to control mastitis in dairy cows in Columbia's Pasto-Nariño region) 2 technical leaflets in Spanish – treatment of guinea pigs and protocol for the management of bovine mastitis: Cartilla cuyes y Cartilla mastitis	Online publication on Ruralter in progress

Examples of complementary publications that can be consulted (non-exhaustive list):

- Identification of some plants used in ethnoveterinary medicine in Sinematiali (Northern Ivory Coast): https://m.elewa.org/Journals/wp-content/uploads/2019/03/3.Kone-Cedessia.pdf
Special dossier: "Médecine ethnovétérinaire" (Ethnoveterinary medicine) from la revue Ethnopharmacologia, volume 62, 2019: http://www.ethnopharmacologia.org/boutique/ethnopharmacologia-62-decembre-2020/

- Connaissances ethnovétérinaires des pathologies camélines dominantes chez les Touaregs de la région d'Agadez (Niger) (Ethnoveterinary knowledge of dominant camel diseases among the Tuaregs of the Agadez region (Niger)), 2006:
http://camelides.cirad.fr/fr/science/pathotouareg1.html

Also as an example, the box below includes some clinical signs and control practices by livestock farmers observed in village contexts by ITRA (Togolese Institute of Agronomic Research) in Northern Togo and some related research questions.

Clinical signs described by the livestock farmer	Disease suspected by the specialist	Village control practices
Loss of appetite Bird plumage puffed up Greenish diarrhea Enlarged head Leg paralysis Torticollis and sudden death	New Castle disease	The poultry farmer adds the following bark types to the drinking water: - cashew tree (anacardium occidentalis); - African locust bean (parkia biglobosa); - mango tree (manguifera indica); - or African mahogany (khaya senegalensis). Tobacco, aloe vera, neem (azadiracta indica) or chili leaves are sometimes used.
Presence of bumps or nodules on crest, barbs, beak and around the eyes	Avian pox	Mixture of potash (or traditional soap) and red palm oil. Lemon juice and ash mixture, Baobab fruit powder, African locust bean, or shea butter
Extremely weak, diarrhea Loss of appetite, Presence of worms in droppings	Internal parasitic diseases	Powder of leaves or bark of tobacco, shea butter, cashew, moringa and papaya seeds or potash in drinking water.
Diarrhea (whitish, gray, yellow, green or bloody)	Coccidiosis Salmonellosis Avian cholera (pasteurellosis)	Barks of African locust bean, shea, African mahogany, cashew, neem, vernonia sp, euphorbia hirta Lemon juice
Diarrhea (whitish, gray, yellow, green or bloody)	Coccidiosis Salmonellosis Avian cholera (pasteurellosis)	Barks of African locust bean, shea, African mahogany, cashew, neem, vernonia sp, euphorbia hirta Lemon juice
External bloodsucking parasites	Ticks Fleas	To kill ticks and fleas, farmers use bamboo, lemongrass and calotropis procera leaves, as well as banana peels, onion slices and potash

APPENDIX 7

List of active neonicotinoid-type substances or substances with an equivalent mode of action recognized as very harmful to domestic and wild bees

(These substances are banned in France and/or partially in the EU)

Active substance	Family
Acetamiprid	Neonicotinoid
Clothianidine	Neonicotinoid
Dinotefuran	Neonicotinoid
Flupyradifurone	Organochloride
Imidalclopride	Neonicotinoid
Nitenpyran	Neonicotinoid
Sulfoxaflor	Sulfoximine
Thiaclopride	Neonicotinoid
Thiamethoxam	Neonicotinoid

APPENDIX 8

Exercise to improve the use of synthetic and natural pesticides

Exercise used in Kita, Mali in 2018 and designed during training based on farmers' practices participating in these two training courses

Note: Farmers in these cotton-growing areas use numerous carcinogenic, mutagenic and reprotoxic pesticides (= CMR). Most of those mentioned below are nevertheless authorized by the CSP. Few of them have understood the mode of action of the products, which occasionally leads to very inappropriate applications. **When it comes to chemical pesticides or natural products, it is always very beneficial to consider their mode of action.**

This exercise was conducted in Kita in groups of 5 to 6 people (farmers and technicians mixed). Its lasted a total of approximately 3 hours (1h30' for the exercise itself and the same amount of time for the feedback). It allowed for valuable discussion regarding the preparation of the spray mixture, how they are used depending on the products, crops and climatic conditions. It also provided an opportunity to discuss the need for proper protection when preparing or spraying a certain spray mixture from natural products with tobacco or neem.

1. Name a total weed killer (which destroys all plants) absorbed via the leaves and the name of a selective herbicide for corn that is primarily absorbed via the roots *(selective herbicide = herbicide that does not destroy the crop to which it is applied).*

Answer: As total weed killers, products based on glyphosate such as Kalach and many others (very long list of commercial names) and, as selective weed killers for corn, products based on atrazine, acetolachlor or pendimethalin (also numerous commercial names).

2. What are the differences in the mode of action between pendimethalin and glyphosate?

Answer: Pendimethalin acts mainly via the roots and glyphosate via the leaves.

3. Bad weather is approaching. It could rain in the next half hour.
   a)I want to apply a glyphosate-based herbicide. Should I go ahead with application?
   b)I want to apply a herbicide based on pendimethalin (or atrazine, alachlor, acetolachlor). Should I go ahead with application?

Answers:
   a) Glyphosate should not be applied because foliar herbicides are often slowly absorbed and can be washed off by rainfall directly after application. For glyphosate, the information on the containers generally specifies 4h without rain. In fact, it all depends on the amount of rain. If there is only 1mm, then there's no problem.
   b) For pendimethalin, atrazine, acetolachlor, the opposite is true as the rain allows the product to better penetrate the soil. However, to avoid the risk of washout and to promote the penetration of the product into the soil, it is preferable to spray it on wet soil (and therefore just after the rain).

4. My corn plot is on a slope. My neighbor's cowpea plot is located below this plot. In the event of heavy rainfall, the runoff from my plot ends up on my neighbor's plot. If I use pendimethalin or atrazine for weed control on my corn crop, what problems does heavy rainfall pose?

Answer: Pendimethalin (and other products that act on the roots) can be washed onto your neighbor's plot during heavy rainfall and cause significant damage.

5-I want to apply a herbicide absorbed via the leaves but the wind is quite strong. What risk does this pose for neighboring plots? What risk does this pose for young trees on my plot?

Answer: Pesticides and in particular herbicides should not be applied when it is windy (in France, this is legally prohibited at wind speeds in excess of 19 km / hour). Damage to neighboring plots can be very severe, particularly when foliar herbicides are used. The risk can be the same for the shrubs surrounding or present in the plot. There are two methods for reducing this risk: (1) Use a cover; (2) work with low pressure and flat spray nozzles; never with the very fine droplet nozzles used to apply insecticides.

6. What happens if I use pendimethalin (or alachlor, acetolachlor and atrazine) for weed control on my corn plot and my wife has planted cowpeas, okra and guinea sorrel?

Answer: Pendimethalin (and other products that act on the roots are registered as weedkillers for corn) will be absorbed by the roots of the associated crops and will kill them or reduce their yield (legumes, okra, etc... are indeed very sensitive to these products). Another concern is that the shea, African locust bean, etc. will be unable to regenerate.

7. It is very hot and dry. Can I go to the field and apply a chemical or natural pesticide that is primarily absorbed via the leaves? (whether a herbicide, fungicide or insecticide).

Answer: When it is very hot and dry, the stomata of the leaves close. This greatly reduces the penetration of pesticide sprays. Therefore, pesticides should not be used in such conditions.

8. Name the insecticides that are fast acting on sprayed insects (however, they will have to be reapplied in the event of rain)).

Answer: Natural and synthetic pyrethrins have a fast, rapid effect. This group of insecticides includes products based on natural pyrethrum, deltamethrin, cypermetrhine, lamda-cyanothrin, etc. Because they are fast acting at very low doses, they are generally less toxic to humans than other families of insecticides. On the other hand, they destroy the majority of beneficial insects... Their repeated use has many harmful effects such as the emergence of resistant insects as well as the destruction of bee populations and beneficial organisms. Such pyrethrin-based insecticides should no longer be applied as frequently!

9. Name the insecticides that penetrate the plants (they are called systemic insecticides and should not be reapplied in the event of rain).

Answer: Most organophosphate and organochlorine insecticides penetrate plants and have a systemic effect. This is also the case for neonicotinoids such as imidachloprid (gaucho) or acetamiprid which are very harmful to bees and are highly persistent.

10. If I want to kill as few bees (and other beneficial insects) as possible, what time of day should I apply my insecticide?

Answer: It is recommended that you work late in the evening when bees (and other beneficial insects) are no longer in the field. However, this will not rule out an impact on the bees if they drink the dew that collects on the leaves, which may contain recently applied pesticides.

11. Calculation: With the herbicide nozzle on my backpack sprayer, taking into account my forward speed and the type of nozzle I use, I need about 10 full backpack sprayers to treat one hectare (my sprayer holds 15 liters). To protect my cowpea plot from pod borer attacks, I bought a container of insecticide sold by an NGO (neem extract based product). It says on the container that I have to use two liters per hectare. How many milliliters (or cm3) of product should I fill in each 15 liter sprayer?

Answer: With this type of nozzle and my forward speed, 200 milliliters of product (the tenth of the specified dose for one hectare).

12-What type of nozzle should I use for herbicide applications? And for insecticide treatments?

Answer: Flat jet nozzles for herbicides and mist jet nozzles for insecticides (we want ultra fine drops). For fungicides, flat jet nozzles if the vegetation to be treated is not too mature and mist nozzles if it is.

APPENDIX 9
Practices implemented on a farm in Angers to significantly reduce the use of pesticides and eliminate highly toxic pesticides
(field report V. Beauval and J.F. Haulon)

1. Farm profile

From 1981 to 2010, GAEC de Varanne cultivated 66 ha in Louresse near Doué la Fontaine in the Saumur region. The farm consisted of an average of 15 ha of seed crops (hemp, several vegetables, etc...) and 50 ha of field crops (wheat, sunflower, beans, corn, fallow land and grass belts with grasses and white clover). Our soils are clay-limestone, often deep, with clay content ranging from 15 to 40% and pH above 7. About 30 ha are at the bottom of the valley. The farm is traversed by the pont de Varanne creek and its forebay over a length of 2300 meters near a creek which runs into the Layon, a river severely polluted with pesticides *(the quantities of pesticides found in certain months can be 20 times higher than the limit set out in the directive framework of the EU that came into force in 2015!).*

The 30 ha of the lower part of our farm include along the watercourses 2 ha of **grass belts** consisting of dactyl + fescue + white clover and lined with **3.5 km of hedges** with substantial biodiversity including hedges with multiple use *(firewood and biodiversity.*

2. Our agronomic practices to reduce the use of pesticides

Our main objective has been to test sustainable production practices while achieving relatively high productivity as our soils have significant potential. We have adopted a global approach based on frequent observations of the soil and crops, practicing crop rotation, selecting the hardiest varieties, increasing biodiversity, refraining from the use of any non-essential chemical treatments, etc...

Thanks to the agronomic choices summarized below, the objectives of Ecophyto 2018 (halving the use of pesticides) were achieved in the mid-1990s and CMR products were no longer used.

The selected practices included:

1. **Observing crop rotation:** This is of crucial importance for large crops. Our rotations are mainly quadrennial (for example, wheat/corn or beans/wheat/hemp or sunflower). Without ruminants or alfalfa, it was unfortunately difficult to perform prolonged rotations.

2. The **choice of disease-resistant varieties:** For example, by choosing our sunflower varieties carefully, we have never needed to use insecticides and fungicides on the plants.

3. For wheat, we have been using **combinations of varieties with the same characteristics** *(early maturity, baking properties, height...)* but with varying resistances to diseases for about fifteen years. By increasing the biodiversity cultivated on our plots, we are subject to fewer risks when we sharply reduce the doses of fungicides.

4.**Refraining from treating seed with systemic insecticides:** initially, rejection of the infamous "T3" which contained lindane and now rejection of Gaucho and Regent. These products raised suspicion from the start based on their toxicological profile. Many of these systemic insecticides kill earthworms and other soil fauna. However, soil vitality is an essential component of its fertility...

5. **Widespread mechanical hoeing** of spring crops *(and sometimes rape)* with a Fendt tool carrier equipped with a 6-row weeder placed between the tractor wheels.

6.For weed control in wheat: removal of substituted ureas suspected of being carcinogenic *(isoproturon, chlortoluron, etc.)* and replacement with active ingredients deemed to be of less concern *(iodosulfuron, bifenox, meso and metsulfuron, etc.)* and used at much lower doses. **The families of active ingredients are alternated in order to reduce the risks of resistance** *(wheat returns to a plot every two years, the same herbicide family returns only every 4 years).*

7. To **control slugs:** it is recommended that populations of their natural predators*(carabids for example) are maintained.* We did not use slug pellets such as measurol, whose toxicity to the soil fauna and carabid beetles raises concerns. Metaldehyde treatments are most often limited to plot edges.

8. **It is always essential to observe crops at key stages**, even if this is very time-consuming.

9. **The use of biological control whenever possible. Trichogramma** have proven effective against the corn borer for more than fifteen years.

10. **Taking into account the different degrees and forms of toxicity of phytosanitary products with the use of the ACTA phytosanitary index.** For instance, for corn, we used herbicides “exempted from classification” such as mesotrione or nicosulfuron rather than old active ingredients with a very poor toxicological profile such as alachlor or metolachlor [*products which, unfortunately, were sold widely following the atrazine ban).*

11. **Reducing doses whenever possible:** in particular, by performing treatments when humidity, wind and temperature conditions are favorable *(which, as with the observations, suggests one must wait for the right moment).*

Other GAEC practices that influence the use of pesticides and the management of weeds and pests:

12. **Sowing wheat using simplified cultivation techniques (SCT)***(several types of tools: direct seeding machine from our CUMA or a conventional seeder after very shallow tillage).* Performed after a well-cultivated summer crop *(such as sunflower, corn or hemp)*, SCTs often help to limit or avoid the use of graminicides on wheat.
1
3. The practice of **winter ploughing every other year,** specifically for spring crops *(the soil is bare from mid-December to April, i.e. generally 5 months out of 24).* We practice "agronomic ploughing" limited to a depth of 15-20 cm that helps to keep weedy grasses such as the vulpin and particularly the brome and vulpie seeds at a sufficient depth.

14. SCT sowing of **catch crops** following wheat (e.g. mustard, vetch, faba bean, at least when there is sufficient rainfall in the summer).

15. Collective trapping of coypu *(conducted in consultation with the farmers located upstream and downstream of the 2 streams crossing the farm).*

APPENDIX 10

Composition and use of 27 preparations based on natural products identified by the FFGM Northern Togo project from 2014 to 2018 in vegetable and field crops

Note: This is a basic list of sheets describing preparations based on natural products collected in Northern Togo and in other countries of West and Central Africa. The AVSF project team has not evaluated the effectiveness of the majority of these preparations.

A more scientific survey of plant-based preparations used in Africa and their effectiveness should be carried out by the CIRAD KNOMANA project of the INRA-CIRAD Glofoods metaprogram. This KNOMANA project, for "Knowledge management on pesticides plants in Africa" started in June 2017 and **aims to identify plants with pesticide use, their specific uses, their modes of action, the organisms they are likely to target** (cf. https://www.cirad.fr/actualites/toutes-les-actualites/articles/2017/science/recenser-les-plantes-naturellement-pesticides-en-afrique-knomanae and https://hal-lirmm.ccsd.cnrs.fr/lirmm-02344159/file/Martin_et_al_2019_WAOC.pdf).

At this stage, the KNOMANA project publications do not yet appear to be usable in a training guide for technicians and farmers' leaders. Let's hope that they will be very soon!

Sheet N° 01	**Neem powder for aphids and thrips**
	Preparation for 400 m²: • 1kg of neem powder in 15 liters of water • Soak for 24h • Filter without diluting and spray
Sheet N° 02	**Neem oil for aphids and thrips**
	Preparation for 400 m²: 150ml of neem oil in 16 liters of water
Sheet N° 03	**Tobacco and chili powder based acaricide**
	Preparation for 400 m²: • 1kg of soaked tobacco leaves • 100g of chili powder • 2 spoonfuls of oil • dilute the mixture in 15 liters of water
Sheet N° 04	**Preparation based on chili, garlic, onion and neem against various insects**
	Preparation for 400 m²: • 1kg of neem powder in 15 liters of water • Soak for 24h • Filter without diluting and spray
Sheet N° 05	**Neem powder for aphids and thrips**
	Preparation for 400 m²: • 100g of garlic • 500 g of onion • 50 g of chili • 500 g of neem powder • 5 liters of water • Soak for 24h • Filter and fill the contents to 16 liters
Sheet N° 06	**Dry neem leaves for numerous insect species**
	Preparation for 400 m²: • Dry the neem leaves in the shade • Crush 1 kg of the dry neem leaves into a powder • Place in 10 liters of water • Let stand for a day • Filter and treat without diluting
Sheet N° 07	**chili and soap powder**
	Preparation for 400 m²: • Crush 100g of chili powder • Dilute in 2 liters of water • Filter and add 5 times the volume of water or 10 liters • Add 10 g (2 pinches) of soap
Sheet N° 08	**Make an insecticide with neem seeds**
	Directions: • Pick or collect ripe fruits, remove the pulp (good fertilizer so do not discard) • Remove any moldy seeds • Dry the seeds in the shade • Store seeds in a dry and ventilated place (not in plastic bags)
Sheet N° 09	**Use of neem leaf powder**
	Directions: • Dilute 500g in 10 liters of water For a concentrated solution, one can add up to 1.5kg in 10 liters of water. • Let soak for 24h then filter • Add liquid soap in a dose of 1% (100ml or 100g for 10 liters of solution) • Mix well and use immediately otherwise it will lose effectiveness

Sheet N° 10	Using neem leaves
	Preparation for 5 liters of solution: • 2 kg of leaves (160 kg for 1 ha) • Crush or grind the leaves • Put them in water and let them soak for at least 12 hours • Filter the mixture and add 10 l of soapy water (100ml or 100g)
	Application: Dosage: Apply twice weekly in the event of severe infestation otherwise every 7 days for 50 m2
Sheet N° 11	**Use of neem oil**
	Directions: • Choose healthy dry seeds • Cold press to extract the oil • Keep the oil out of the sun and heat • Dilute the oil in 5 liters in 500 liters of water for 1ha. • Add 1ml (1g) of soap to 1l of water
	Application: • Treatment every week in case of severe infestation or every two weeks • The neem oil solution is more effective than the seed solution which is more effective than the leaf solution. • Adding soap helps the active mixtures to better adhere to plant leaves • For spraying, make sure to treat all parts of the plant • Apply the treatments the evening after watering
Sheet N° 12	**Use of neem oil**
	Directions: • **Part used:** Leaf • **Effect:** Fungicide for blight • **Directions:** finely crush 1kg of fresh leaves; mix with 1 l of water, let stand for at least 6h then filter and add 30 g of soap. This liquid is diluted in a ratio of ¼
	Application: 1l/20m2 every three days
Sheet N° 13	**Making insecticide with papaya leaves**
	Directions: • **Part used:** Leaf • **Effect:** Noctuidae and larvae, defoliators, grubs • **Directions:** finely crush 1kg of fresh leaves; mix with 10 l of water, let stand for two days, then filter and add 30g of soap.
	Application: 11l/20m2 every three 3 days

Sheet N° 14	Make pure insecticide with papaya leaves
	Directions: • **Part used:** Leaf • **Effect:** Fungicide • **Directions:** finely crush 1kg of fresh leaves; mix in 10 l of water, add clay; put the mixture in a container and put the lid on leaving an opening to allow air to enter; stir once a day; after 15 days of fermentation, filter and use directly without diluting.
	Application: As a preventive measure: 1l/10m2 every 15 days and as a curative measure: apply 2l/10m2 as soon as symptoms appear
Sheet N° 15	**Make an insecticide with chili peppers**
	Directions: • **Part used:** Fruit • **Effect:** Insecticide • **Directions:** crush the dry fruit. Let 2 spoonfuls of powder soak in 10 l of water for 12h. Take 2 liters of the mixture and add 4 liters of ready made soapy water.
	Application: • **As a preventive measure:** 1l/10m2 every 10 days one month before the supposed spread of the insect • **For curative purposes:** 1.5l/10m² every week
Sheet N° 16	**Make an insecticide for aphids based on chili powder**
	Directions: • 100 g finely ground chili pepper • Add 1 l of water and shake vigorously • Filter and dilute 1 part of this solution in 5 parts of soapy water
	Application: for aphids spray every week - 1liter/20 m².:
Sheet N° 17	**Make an insecticide with chili peppers**
	Directions: • Boil 500g of thinly sliced ripe chilis in 3l of water for 15 to 20 minutes. Add 30 g of soap • Add another 3 liters of water, let cool and filter.
	Application: • Application once a week if there is no rain but 2 to 3 times in case of rain. • 1 liter for 10 m²
Sheet N° 18	**Make an insecticide for locusts, borers, whiteflies based on chili, garlic and onion**
	Directions: • Mixture that can be used against locusts, chewing insects, whiteflies • 1kg of chili + 0.2kg of garlic + 0.5kg of onion + H2O for 24h, • Filter, fill the contents in 16 liters for a sprayer.

Sheet N° 19	Make an insecticide for bean leaf beetles based on chili, garlic and onion
	Directions: • Mixture for use against bean leaf beetles • 30g of chili+50g of garlic+500g of onion+12lH2O soak for 24h • Filter and spray on the bean
Sheet N° 20	**Make insecticide for aphids based on chili and neem**
	Directions: • 50g of chili + 2.5kg of neem leaves • 2 spoonfuls of soap + H2O. • Let soak all night. • Filter and fill the solution to 20 liters
	Application: Spray every week for whiteflies
Sheet N° 21	**Use chili and neem to make an insecticide for aleurodes, diamondback moth and other phloem-feeding insects etc...**
	Directions: • 50 g of chili • 200g of neem powder • 4 liters of water • Soak 200g of neem powder in 4l of water for 24 h, • Then add 50g of crushed chili. • Filter and use twice a week
	Application: Spray twice weekly for whiteflies, diamondback moths, other phloem-feeding insects and chewing insects
Sheet N° 22	**Make an insecticide to control the leafroll virus from tobacco leaves and stems**
	Directions: • Crush 1 kg of dry leaves and wrap the powder in a cloth. • Soak the bundle in 9 liters of water, • Seal the container and let soak for 24h. • Crumble a piece of soap and soak 2 pinches in 1l of water, and stir well. • After 24 hours of stirring, press the firmly over the container. Remove the bundle and filter the juice containing the concoction. • Add one liter of soapy water to the filtrate.
	Application: For curative purposes: 0.1l/10m2 every 5 days
Sheet N° 23	**Use rice bran to make a product to control powdery mildew on cucurbits**
	Directions: • 1/3 liter of rice bran • Mix in 10 liters of water. • Let soak for 6h. • Filter and use directly without diluting.
	Application: For curative purposes: 0.1l/10m2 every 5 days

Sheet N° 24	Use of moringa leaves against seedling damping-off
	Directions: • **Part used:** moringa leaves • **Effect:** seedling damping-off • Bury fresh leaves in pots or seedbed in an amount of 1kg/m².
	Application: Spray twice weekly for whiteflies, diamondback moths, other phloem-feeding insects and chewing insects
Sheet N° 25	**Use garlic bulbs to make an insecticide for aphids**
	Directions: • **Part used:** Garlic bulb • **Effect:** insecticide (aphids) • **Directions:** dry and crush the garlic cloves when they are well dried. • Soak 2 spoons of powder in 10l of water for 12 hours. • Mix 2 liters of preparation with 4 liters of soapy water.
	Application: • As a preventive measure: 1 month before the proliferation of the insect, apply every 10 days 1l/10m² • For curative purposes: 1.5l/10m² every week
Sheet N° 26	**Make a citronella-based bactericide**
	Directions: • **Part used:** whole lemongrass plant • **Effect:** bacteria • **Directions:** grind 50g of leaves. • Let soak for a few minutes in 2 liters of hot water; filter.
	Application: •As a preventive measure: spray the soaked mixture + soapy water at a rate of 3l/10m2 every 2 weeks
Sheet N° 27	**Preparation of a broad spectrum insecticide based on chili, garlic and onion**
	Directions: • **Part used:** fruit, bulb • **Effect:** large-spectrum insecticide • **Directions:** crush 1kg of garlic, onion, chili and a small soap pellet. • Let everything soak in 4 liters of water for at least 5h. • Filter
	Application: • As a preventive measure: 3 liters/ha every 2 weeks. • For curative purposes: 6 liters/ ha every 2 weeks

APPENDIX 11

Training module on natural treatments (CNOP Mali)

TRAINING MODULE IN AGROECOLOGY NATURAL TREATMENTS

Page 1

Principal objective

Promotion and expansion of natural treatment methods in smallholder farming.

Specific objectives

*See the **charter** for the common topic*
Farmer agroecology and the charter

Topic 1
Challenges of natural treatments

Topic 2
Principles for preparations

Topic 3
Neem and soap an effective combination

Topic 4
Identify and treat damage on plant leaves

Topic 5
Natural preventative and curative treatment for some legumes

Topic 6
Organize collectively

Topic 7 : Collective evaluation

Expected outcomes

*See the **charter** for the common topic*
The women smallholder farmers have adopted the farmer agroecology charter

Topic 1
Explain the various challenges associated with natural treatments

Topic 2
What precautions are to be taken:
For collecting the ingredients
For the material

Topic 3
Know the 2 neem recipes
Explain the role of soap
Explain the role of insects and particularly bees

Topic 4
Know how to identify damage, its cause and natural treatments to be applied

Topic 5
Know how to identify the causes of damage
Know how to apply the natural treatments to vegetables

Topic 6
Know how to get organized collectively and identify strategies for developing natural treatments

Topic 7
Know how to assess

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TOPIC 1: CHALLENGES OF NATURAL TREATMENTS

Page 3

In our struggle **for food sovereignty and agroecology for farmers, we face many challenges in relation to land,** water and natural resources. By applying different agroecological practices: the combination and rotation of crops, agroforestry, composting, crop biodiversity with farmer seeds or local breeds, balancing our ecosystems and agrosystems, diseases and pest infestation that impact our crops are considerably reduced while at the same time we protect our health and our environment with healthier products.

Chemical products arrived 70 years ago alongside new cultivation techniques and widespread use of machinery approximately. Today, the outcome is catastrophic.

Deterioration of the environment
- Pollution of waterbodies and soils
- Depleted and barren land
- Adaptation of "weeds" and pests to chemicals requiring higher and higher doses, even if they are called microdoses
- Ecosystems, flora and fauna disturbed or destroyed
- Loss of biodiversity
- Soil erosion

Deterioration of health
- Rise in diseases: cancer, deformities...

Social deterioration
- Development of agriculture

DDT is the first known chemical to appear in the 1940s, contaminating humans, animals, plants and the soil, it has been banned but not entirely in Africa!

In spite of the use of chemical products, **1/3 of harvests are consistently lost** because of various parasites that are able to multiply as the result of large-scale monoculture and the use of selected varieties with increasingly fragile genetic heritage.

In the United States **thousands of hectares have been abandoned** because the fields infested with amaranth can no longer be farmed.
Chemicals are expensive, often not conforming to the label and tie farmers to suppliers **with whom they often accumulate debt.**

Today, **farmer innovations in natural treatments** cannot be commercialized because the standardized approval process is made by and for big business and is neither adapted to our means, nor to our needs nor does it preserve our knowledge and know-how of our farmers.

They make a profit by making us sick and treating us!

Six multinationals control the agrochemical sector: **Syngenta, Bayer, Monsanto, Dow, Basf and Dupont.** They are known as the "Big 6". They dominate a virtually unshared colossal market worth 50 billion euros .

These are the same people who make GMOs and hybrid seeds with poor reproductivity, or even sterile ones like the Terminator, which require extensive chemical inputs to achieve a proper yield
These are the same people who own pharmaceutical plants like Novartis

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TOPIC 2: PRINCIPLES FOR THE PREPARATIONS

Page 5

WARNING

The material should only be used for preparing natural treatments!

- Do not use for other purposes
- Do not leave materials or preparations within reach of humans or animals
- Put on gloves

Essential materials

Mortar and pestle, buckets, sieves, sprayer, containers, cloths, gloves...

Filtering technique

After preparing the solution, let it stand for 24 hours, use a clean cloth or sieve to filter the required amount and process immediately.

Be responsible when collecting ingredients

- When collecting, be responsible so as to conserve and allow for adequate replenishment
  - Ensure that the plant, tree or shrub can still reproduce
  - If needs increase, grow crops or plantations with farmer seeds, preferably in collective spaces.
- Choose plants in good condition
- Use clean or even disinfected sharp instruments to:
  - remove or cut the plants so as not to kill them by removing their roots
  - leave branches on trees or shrubs to keep them growing
- Respect the reproductive cycles of the plants, do not cut at the time of flowering
- Do not collect them in areas where pesticides or other contaminants may be present or used, such as roadsides, garbage dumps, gutters, areas surrounding mines, toilets...
- Do not disturb the habitat of fauna and

The role of insects

All organisms in our crops help to keep its ecosystem in balance. The use of weed killers, treatment products and soluble chemical fertilizers destroys this balance. Keep in mind that even our preparations can destroy this balance. Therefore, use them sensibly! The majority of garden organisms are of vital importance to plant health, crop pests only account for a small number of them.
Multiple crop combinations with different flowering times attract many beneficial insects. Ladybugs, lacewings, hoverflies, wasps, carabid beetles, earwigs... are carnivores. As a result, they feed on other insects and micro-organisms.
Spiders are particularly dangerous for insects.

Bees are essential to agriculture and ecosystems. **Without their pollination,** there would be no flowers, no fruits, no grain and no food for humans and animals ...and there would not be as much biodiversity.
Moreover, bees can improve our daily lives with honey, wax, pollen, propolis and royal jelly.

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TOPIC 3: NEEM AND SOAP AN EFFECTIVE COMBINATION

Page 7

The primary natural treatment is biodiversity in our fields and vegetable growing plots

Neem-based natural treatments

The seeds are more effective than the leaves

With neem seeds

Makes 20 liters of preparation

- Collect the seeds
- Dry in the sun
- Put on gloves
- Husk
- Sort: remove all moldy, damaged seeds...
- Crush 3kg of seeds
- Add the powder to 20l of water
- Add 100 gr of natural soap
- Mix, seal the container well
- Let stand for 24h
- Add 100 gr of soap,
- Stir
- Apply

With neem seeds

You will need 80 kg to treat 1 hectare

- Pick 4 kg of leaves
- Crush
- Soak in water overnight
- Filter with a fine cloth or sieve
- Add 1 liter of this preparation to 10 l of water
- Add 100 milliliters of liquid soap or neem oil
- Apply

The dosages of the preparations are only indicative.
With the same ingredients there are sometimes different preparations, it is up to you to:

- Test
- Innovate
- Note on a sheet to be added to this farmer agroecology training binder
- Share your own experiences!

The role of soap

- Add soap or oil to the preparation as a final step to help the product better adhere to the plants.
- Liquid soaps made with potassium are recommended for thrips and also provide mineral salts for the soil.
- **Liquid soaps or soaps made with caustic soda should not be used, risk of burning the leaves.**

Garlic, onion, chili, basil, lemon, papaya, neem... they are our allies, and in our immediate surrounding so we can make natural preparations.

Remember to always have them in stock, stored well in the form of powder, dry...

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TOPIC 4: IDENTIFY AND TREAT LEAF DAMAGE

Page 9

SYMPTOMS ON LEAVES IN VEGETABLE FARMING

SYMPTOMS	CAUSES	NATURAL TREATMENTS	
Pierced leaves *Deformation* *Formation of knots*	Root-knot nematodes	***Neem*** Leaves and powder to be put in the soil, particularly for nematodes	***Manioc*** Mulch with cassava peels and/or • Crush cassava roots • Mix as much juice as water • Crush 4 liters per m^2 • Plant 20 days later
		Manioc • Put 2 spoonfuls of chili powder in 10 l of water • Mix 2 liters of preparation with 4 liters of soapy water • Apply 1 liter to 10 m^2	***Garlic*** • Crush well dried garlic cloves • Soak for 12h, 2 spoonfuls of this powder in 10l of water • Mix 2l of this preparation with 4l of soapy water • Apply 1 liter to 10 m^2
Leaf browning, weakening of crops *Brittle, rolled back leaves*	Mites	**Neem** See recipe under Topic 3, page 4	
Spots of varying size: green-yellow, yellow, brown rot, wilting, withering	Mushrooms bacteria	***Lemongrass*** • Grind 50gr of leaves • Soak 10 mn in 2 liters of hot water • Filter • Add 1 liter of soapy water, • Apply: 3 liters for $10m^2$	***White fly trap*** • Place 200gr of leaves in 1l of water overnight • Grind the leaves • Filter • Add a small amount of soapy water, • Mix well: 3l for $10m^2$
Several different colors juxtaposed in a mosaic	White fly Lack of phosphorous Excess nitrogen	**Neem** • Paint a board approximately 20cm in size yellow and orange. Coat with grease • Put in the field when the paint is dry	**Neem** See recipe under Topic 3, page 4
Leaves eaten (like a window) on cabbage especially	Diamondback moth	• Growing cabbage with **tomatoes** • See page 7 *cabbage*	**Light traps** See above white fly trap

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Page 11

OTHER SYMPTOMS

SYMPTOMS	CAUSES	NATURAL TREATMENTS	
Powdery mildew white color similar to a tissue in different parts of the plant	Mushrooms	**Ash** • Mix one tablespoon of red gum, mango, tamarind and/or eucalyptus wood ash in one liter of water • Let stand overnight • Filter • Plant 20 days later • Add a cup of milk • Dilute again with 3 l of water • Apply	**Papaya** • Crush 1kg of fresh leaves • Mix in 10 liters of water • Filter • Dilute in 4 liters of soapy water and apply **Sweet potatoes** • Crush the sweet potato leaves • Mix with water, filter and app
Gallery on stems	Larvae, weevil	**Neem** See recipe under Topic 3, pages	
Gallery in fruit	Fruit worm	***Ash*** Put wood ash on the leaves and at the base	**Garlic** See recipe in the previous chart
Seedling melt		***Moringa*** • Bury fresh leaves in the ground • As a preventative measure : bury 1kg/m2	

SYMPTOMS IN FOOD CROPS

SYMPTOMS	CAUSES	NATURAL TREATMENTS	
Striga	enrich the plant with compost in poor soil,	Perform crop rotations with cotton, peanut, niebe, Enrich your soil with compost	Spray outside the crop with 20% urea: Burn the striga Reduces seed production
Flowers and seeds eaten on millet, fonio, sorghum...	Large gray-brown Cantharide Nocturnal	**Trap and treatment** • Place blue bowls with soapy water in the field • Collect dead cantharides, dry them and grind them up • Dilute everything in water	**Predators** Grasshoppers Be sure not to disrupt the species' balance!

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TOPIC 5: PREVENTATIVE AND CURATIVE NATURAL TREATMENT FOR VEGETABLES

Always plant lemongrass, garlic, basil, mint, as they have strong repulsive and disruptive odors for combating insects.

VEGETABLES	EFFECT	PREPARATION OF A NATURAL TREATMENT	
Eggplant	• **Recipe for repelling** larvae • **Enhance the natural defenses** of plants against fungi and bacteria	• In a cup, mix 3 cow pies in 10 l of water • Stir every day for 15 days • Sprinkle with clay when the smell becomes unpleasant • Dilute one liter of the mixture in three liters of water • Apply to the green parts of the plants and the fruits	
	Recipe for a curative insecticide for eradicating leafhoppers or jassids, light green, green-yellow insects with shiny, semi-transparent wings	**Neem** • Grind 500 gr = 3 double handfuls of seeds • Mix with 10l of water or 2 boxes of powdered head matchsticks in 1l of water • Let soak overnight. • Spray every 10 days	**Chili** • Chop 100 gr or 12 large ripe peppers • Soak in 11 liters of water for 24h • Filter • Add 5l of water + soap • Apply **Light trap** see page 5
Cabbage	**Preventative recipe** for preventing insects from laying eggs, especially the diamondback moth: small brown butterflies with a white stripe on the back. The larva is white	**Grow with tomatoes** • Boil 2 l of water with 1kg of leaves and chopped stems • Let cool for 5 hours • Filter • Spray the cabbage ever two days when the butterfly is there **Neem** see the recipe page 3	**Garlic** • Grind 1 garlic bulb • Add to 1l of water+soap • Spray immediately **Garlic + onion + chili** • Chop a clove of garlic, a large onion • Add 1 teaspoon of chili powder • Mix everything in 1 liter of soapy water • Filter and treat
Okra	**Curative recipe** for eradicating larvae, cotton thornwort, powdery mildew leafhopper	**Sweet potatoes** • Crush the sweet potato leaves • Mix with water, filter and app	
Green		**Garlic + chili**	**Onion peels**

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beans tomato	**Curative recipe** for eradicating larvae, cotton thornwort, powdery mildew leafhopper	• Finely chop 20 bulbs of garlic • Add 20 gr of chili pepper in 4 hot water + soap	• Mix 100 gr of onion peels in 1 l of water • Let stand for 4 to 7 days
Zucchini, Cucurbitacée	**Curative recipe** for mildew: leaves are covered with a sort of white powder.	**Fly trap** • Place in 0.5 l of water, 100ml of urine, 1 peel of an orange or cucumber • Let stand overnight • Dilute in 15 liters of water. Fill into bottles	**Wood ash** • Spread the wood ash • Perhaps you can also use it for prevention
Onion, Leek	**Curative recipe** for thrip: yellow/ brownish insect with long narrow wings lined with hairs. It scrapes the leaves which become silvery white.	**Soap** • Mix 30cl of liquid soap based on potassium in 5l of water • Shake and apply	**Ash + green lemon** • Mix ½ cup of wood ash + ½ cup of lime (green lemon) in 4 l of water • Let stand for 12h • Filter and treat **Sweet potato** Treat with water used to cook sweet potatoes or cassava
Sweet potatoes	**Preventative and curative recipe** for weevils	**Wood ash** Soak the tubers in the wood ash before planting them deep	Treat with wood ash around the plant
Chilli pepper	Mediterranean fly	**Fly trap** • Mix 100 gr of onion peels in 1 l of water • Let stand for 4 to 7 days in a covered container • Filter and treat	
Potatoes	Potato moth (Doriphore)	**Association of a crop with eggplant to keep away the Doriphores**	

AND AGAINST SMALL ANIMALS

Small rodents	**Make a trap** Bury a metal container that holds ca. 20 liters, so that the top 5 cm is above ground Pour in 5 liters of water with some peanuts in it Apply a generous 3-cm coat of peanut paste along its inner edge. Attracted rats and mice will drown inside.
Snails/ slugs	Bury a metal container that holds ca. 20 liters, so that the top 5 cm is above ground

Pate d'arachide

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TOPIC 6: ORGANIZING COLLECTIVELY

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Reference case

The CNOP agroecology intermediaries for farmers set up **agro-ecology huts, seed huts and biodiversity huts** for farmers to share knowledge, improve, disseminate and maintain the farmer agricultural practices of today and tomorrow! The agro-ecology huts for smallholder farmers are collective, social places where training courses, meetings and farmers' markets are held and where knowledge and seeds are exchanged...

To find collective, legal solutions for the development of natural treatments by communities, in September 2014, CNOP organized the workshop "Current natural treatments for plants and animals and their use in smallholder farmer agroecology" with researchers, state and institutional representatives, associations by questioning them rigorously "How are they tested? How do they get approved? How are they made? How are they distributed, sold at an affordable price?...while protecting the rights of farmers to their innovations. To be continued! **We want to develop regional strategies based on knowledge from smallholder farmers and for smallholder farmers.**

Bakari recalls *"one day some young farmers from his village brought the researchers compost they had made for analysis. They never heard back. But some time later a factory opened in the neighboring region selling compost with a formula that was very similar to theirs!"*

Moctar, arborist trainer intermediary for CNOP, in the context of smallholder agroecology, has made different types of natural treatment preparations which he has experimented with and produced in liquid and powder form. He explains how he did it, the ingredient properties, how the product was made, its basis and how to use it. *"The first researchers are the farmers, farmers test them, but the regulations to promote our innovations do not suit us. They even prevent us from progressing or even existing because the research and laws – through the lobbying of private interests like those of companies – are not adapted to our real-life situations."*

Create specific crop areas with a grove of trees, the symbol of our regions selected by the farmer intermediaries, for natural preparations with a securely sealed storage facility for the material and conservation of ingredients and preparations.

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THEME 7 : EVALUATION

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Daily evaluation

- Each morning, review of the previous day's events by one or several participants
- Perform the pre-evaluation of the topic of the day
- At the end of the day, evaluate the satisfaction of participants regarding the course of training and make necessary adjustments.

Final evaluation

Evaluate general satisfaction with a grading scale by module

Designation	Useful	Not useful	Acceptable	Good	Excellent	Observations
Training						
Conditions of acceptance						
Animation						
Participation						
Content						

Evaluate knowledge and practices learned individually or collectively

Some ideas for evaluation; remember to use the cards:

- Define farmer agroecology in a few words.
- Define the different uses of natural treatments.
- Know how to identify the symptoms on vegetables and food crops
- Know how to prepare a natural treatment.
- Outline the advantages and use of natural treatments.
- Describe one or several stages of preparing a natural treatment.
- Get organized collectively in order to choose the ingredients, prepare and conserve them for commercialization.

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APPENDIX 12

Examples of practices based on phytotherapy and aromatherapy in cattle farming in Western France (field report D. Lebreton)

USE OF PHYTOTHERAPY AND AROMATHERAPY ON A FARM IN WESTERN FRANCE
Field report of Dominique Lebreton, livestock farmer and member of the board of directors of AVSF

PHYTOTHERAPY
Phytotherapy uses powdered plants as a preventive measure (herbal tea) and plant extracts in liquid form as a curative measure. Plant extraction methods and those frequently used in phytotherapy can be found in the document "Utiliser la phytotérapie en élevage" (Use of phytotherapy in breeding). - http://www.civambio53.fr/wp-content/uploads/2017/05/articles-Phyto-Aroma-Juillet-2015.pdf.
On our farm, we use phytotherapy to regulate physiological functions, detoxification and to strengthen immunity. We choose from a range of plants for prevention during the periods of risk, for curative purposes or to help with recovery. We prefer a synergy of several plants rather than using a single plant. Typical doses amount to 100 grams of the plant/liter of water. In the event of a 3-plants mixture: 100 gr/plant in 2 or 3L of water. To be repeated 1 to 3 times depending on the case.

AROMATHERAPY
The **essential oils (EOs)** have a powerful effect and act like a medication (allopathy). Just because they are natural products does not mean they are harmless! As a result, precautions should be taken when using them and doses should be respected. Our rules for use:
• Use oil or fat for the mixtures. Never mix in water.
• Also use them in honey or sugar.
• Do not use them in their pure form (particularly irritating EOs).
On our farm, we frequently use a mixture of 3 to 5 EOs
In terms of oral doses:
• The EOs are non-irritating and non-toxic:
  * 500-600 kg adult cattle: 1ml (30 to 35 drops)
  * Calf, sheep or goat: 0.20ml (6 drops)
  * Equine 500kg: 15 to 25 drops (0.5 at 0.66 ml)
• The irritating EOs (phenolated: oregano, clove and cinnamon):
  * 500-600kg adult cattle: 0.5ml (15 drops)
  * Veal, sheep, goat: 10 drops

Maximum amount administered, carrier oil, frequency and duration

Weight of the animals	Maximum oil quantity	Carrier oil	Frequency and duration
500-600 KG	5 ml	45 ml	2 times daily for a period of 3 to 7 days (depending on progression) If this is a chronic problem, once daily.
200-250 KG	2.5 ml	22.5 ml	
45-60 KG	1 ml	9 ml	
5 KG	1/2 drop to 1 drop/KG of body weight	A small amount of oil	

ANTI-INFECTIOUS
A mixture called APA at GENTIANA replaces certain antibiotics. It is composed of:
- tea-tree 25%
- palmarosa 25%
- bay laurel 25%
- COGA 25% (Chinese cinnamon + oregano + clove + athymol thyme. all 4 in equal parts)

Mix: 5ml of the EO in 45ml of the sunflower oil for one adult cattle
1ml of EO in 9ml of sunflower oil for salves, sheep, goats.

VIRAL DISEASES
Pneumonia, bronchitis: start the first days with APA (see above) then continue with an expectorant mixture:
- athymol thyme
- oregano
- tea-tree
- eucalyptus globulus
- Scotch pine
- rosemary-verbena
- ravintsara

DISEASES

▸ After calving: lack of appetite, non-delivery
Phytotherapy: mix of thyme, rosemary, nettle, solidago, hydrastis, horse chestnut, barberry, wormwood. 1 to 2 times daily for a few days.
Aromatherapy: we can intensify it with 30 drops of COGA, 30 of palmarosa, 30 of tea-tree, in 45ml of sunflower oil, administered orally.
If there is still no delivery, provide local intrauterine disinfection: 30 drops of tea-tree, 30 of palmarosa, 20 of geranium, 20 of lavandin and 10 of clove in 25ml of cleansing milk. Inject the mixture into the uterus with the help of a probe. To be renewed every 2 days until elimination of the placenta (which is expelled naturally around the 9th day).

▸ Mastitis
▸ Mild mastitis:
Phytotherapy: artichoke, burdock, milk thistle, echinacea, nettle, meadowsweet, thyme
Aromatherapy: via massage in the area: 15 drops of COGA, 20 of tea-tree, 20 of laurel, 20 of lemon eucalyptus, 20 of cypress and 20 of mint in 45ml of sunflower oil. Repeat for several days in the

morning and evening.
Sunflower oil is most suitable for udders because it penetrates better.

▸ Colibacillosis mastitis:
Phytotherapy: 2L of herbal tea with 100gr of artichoke and 100gr of rosemary, 3 times at 6h interval.
Aromatherapy: 10 ml of peppermint, 10 ml of lemon eucalyptus, in 80 ml of rapeseed oil to be consumed in the morning and evening for 4 to 5 days.
Drain the affected area often and make a plaster of clay and EO mixture (500 gr of clay (55% clay and 45% water)), 5 ml of peppermint, 5 ml of lemon eucalyptus and 50 ml of sunflower oil.

▸ Mammary edema:
Phytotherapy: plants that stimulate immunity, antitussives, expectorants
Aromatherapy: 25 drops of cypress, 25 drops of lemon eucalyptus, 25 drops of niaouli, 25 drops of geranium in 15ml of sunflower oil or sweet almond oil for massage.

▸ Wounds on teat, ulcer on sphincter: Prepare an ointment in 100 gr of lanolin or milking fat, EO 90 drops of tea-tree, 60 of palmarosa or geranium, 20 of COGA, 90 of lavandin and 60 of laurel.

▸ Infectious diarrhea in the newborn: dose for 40-50KG (calf, goat, sheep)
Phytotherapy: plants to treat enteritis, stimulate vitality and immunity
Aromatherapy: 6 drops of COGA, 6 of basil, 6 of tea-tree in 10ml of sunflower oil or better of liquid paraffine given orally 2 times a day + rehydrator.

▸ Interdigital panaritium: If taken at the beginning,
Aromatherapy: make a paste with clay and apply a plaster between the hooves twice a day. Mix 30 drops of COGA, 30 of tea-tree, 30 of laurel and 30 of lavandin into the clay.

▸ Heavy cough, bronchitis, a mild cold:
Aromatherapy: 40 drops of COGA, 50 of tea-tree, 30 of Scots pine and 30 of eucalyptus globulus in 45 ml of sunflower oil. If viral, see above VIRAL DISEASES.

▸ Acute bronchitis, irritation cough (dry and painful))
Phytotherapy: Elecampane, thyme, mullein
EO: Cypris, fennel

▸ Bluetongue disease (cattle or sheep): Antiviral effect and stimulating effect on immunity and vitality:
Aromatherapy: 30 drops of ravintsara, 30 of laurel, 30 of tea-tree, 30 of niaouli in 45 ml of canola oil.

▸ Keratitis: In the beginning, put a few drops of tea-tree mixed in honey and apply it to the eye twice daily for several days. Tea-tree is a very mild EO oil, it can be applied in its pure form.

To go further in the French context, see also:
-http://www.agriculture-durable.org/ressources/les-pourquoi-comment/pourquoi-comment-utiliser-les-huiles-essentielles-en-elevage-bovin/
- the thesis of Delphine Jeune: “Pratiques de médecines alternatives en élevage bovin français” (Alternative medicine practices in French cattle breeding), 2011, University of Lyon 1.

NOTES