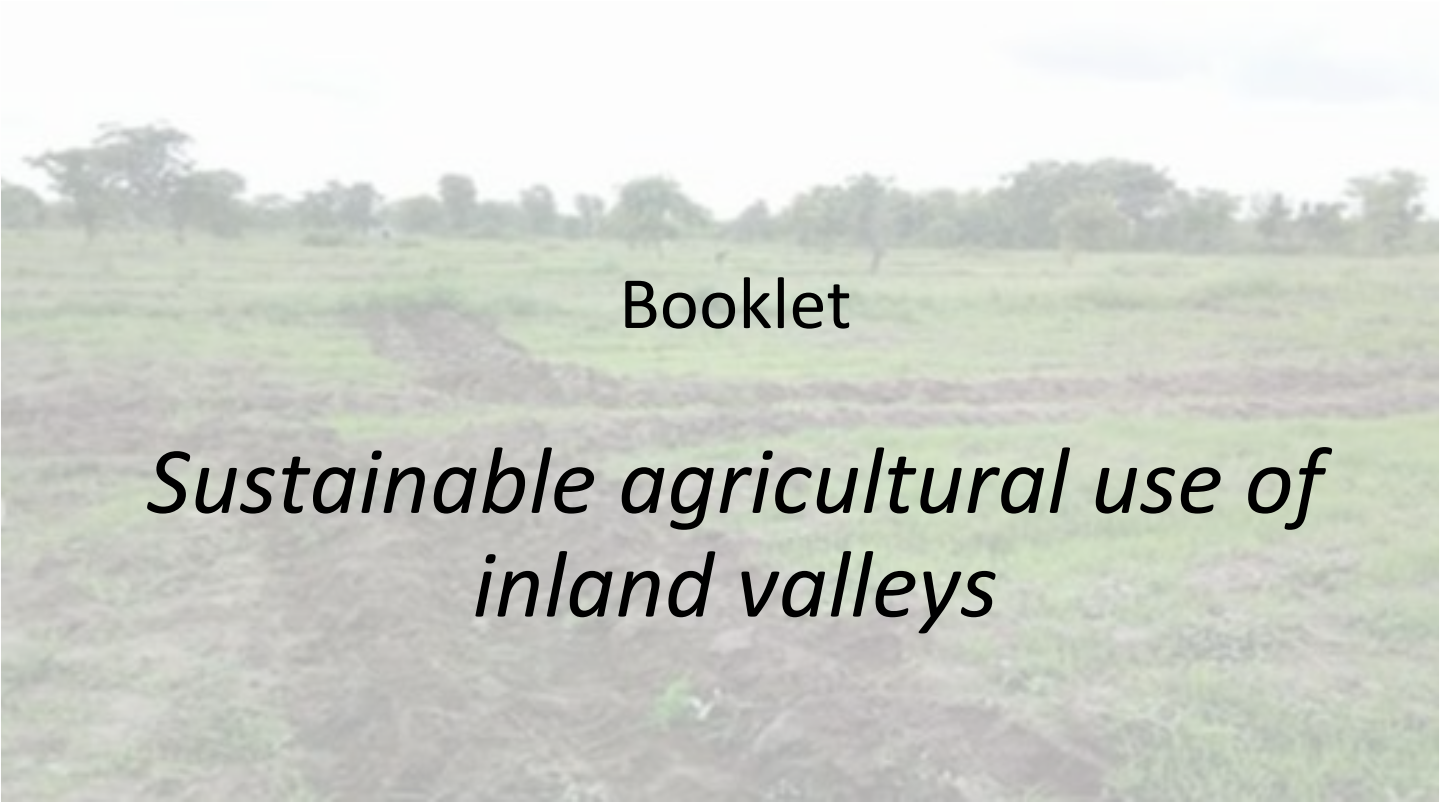

Booklet

Sustainable agricultural use of inland valleys

Summary

About AfricaRice and Afrique-learning

AfricaRice:

AfricaRice is a leading pan-African rice research organization committed to improving livelihoods in Africa through solid science and effective partnerships. AfricaRice is a research center of CGIAR, which is part of a global research partnership on future food security. It is also an intergovernmental association of African member countries. Today, it has 30 member countries. The mission of AfricaRice is to contribute to poverty reduction and food security in Africa through research, development and partnership activities, aimed at increasing the productivity and profitability of the rice sector so as to guarantee the sustainability of the agricultural environment.

Afrique-Learning:

Afrique-learning is a Beninese cooperative which creates and manages vocational e-learning courses specially designed for African youth. Courses are tailor-made in collaboration with experts in the field with the aim of producing interactive, illustrated, interesting and easy-to-study courses that provide the student with important information in simple and appropriate language. Learning is done independently at the student's own pace, it is assessed and a course certificate is attained following a final test. Courses are available on computer, smartphone or android tablet. They only require a very modest bandwidth and are therefore within the reach of students. Registration and classes are free.

Acknowledgements

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Context of the guide

In the current context of biodiversity loss around the world, acting sustainably is very important. The producer must be able to manage the inland valley in a sustainable way, which allows him/her to use the inland valley for a long time, successfully, while respecting its biological and ecological environments.

Using an inland valley in harmony with its environment to maintain the biodiversity of the inland valley

Strong demographic growth, the loss of soil fertility in the plateaux and food insecurity have led peasants to use the inland valleys for agriculture. The inland valleys in fact have fertile land and better water conditions for agriculture (arboriculture, market gardening, fodder crops, food crops). They are sources of food production and income.

Better exploitation of the inland valleys requires reconciling diversified agriculture with the preservation of the plants and animals that are in the environment. This guide focuses on strategies for developing inland valleys in harmony with the environment.

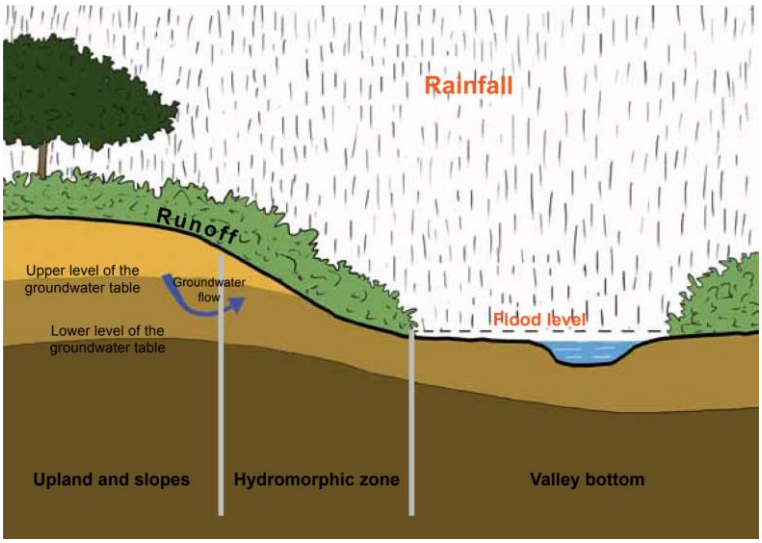
Sustainable agriculture

This is food production that looks towards the future, which ensures the continuation of production over the long term. The objective is to reduce the environmental impact of agriculture so that land, water, plants and animals remain usable for future generations.

An inland valley developed by agriculture [1]

What is an inland valley?

Inland valleys are the downstream parts of drainage networks. They are places where the runoff from the plateaus is concentrated. The water is loaded with organic and mineral matter from the plateaus which accumulates in the inland valleys, thus giving the soil exceptional fertility.



Water runoff from the plateaus to the inland valleys [2]

Inland valleys wealth

Biologically

The inland valleys are environments rich in animal biological activity (termites, earthworms, ants, snakes, birds, rodents, etc.) and in plant biological activity through the action of the roots. The inland valley vegetation constitutes a habitat for the animals.

On the agricultural level

Inland valleys offer the following advantages for agriculture:

- water availability in the soil beyond the rainy season;
- accumulation of organic matter from the plateaus;
- fertile land for market gardening, arboriculture, and agricultural diversification (rice, corn, sorghum, onion, chilli and other vegetables, cowpeas, sweet potatoes, etc.).

The socio-economic interest of inland valleys

As a consequence of their agricultural interest, the inland valleys offer the following socio-economic advantages:

- they allow greater agricultural production and yield;
- they promote food security and increase peasants income and standard of living.

Development of inland valleys

Threats to the inland valleys

Although inland valleys are very useful for agriculture, they face major threats: systematic destruction of existing vegetation, soil degradation, disease and death of plants and animals due to absorption of agricultural chemicals, and disruption of the food chain. Destructive hydro-agricultural development of the soil is also a major threat to the inland valleys, as well as conflicts among peasants because of water contamination. It is therefore important to raise awareness about their sustainable use.

Sensitization to the fragility of an ecological system and definition of biodiversity

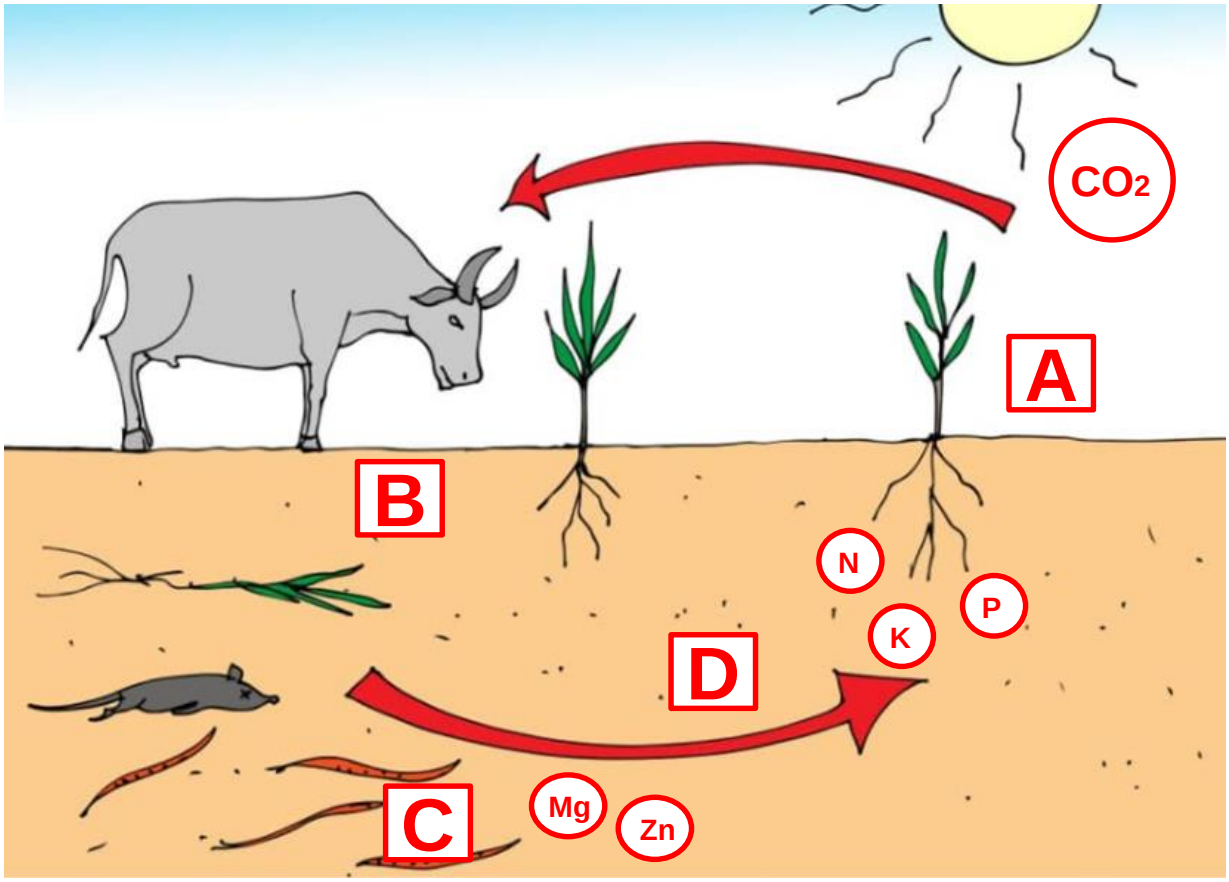
Considering the threats to the inland valleys, it is important to raise awareness about the sustainable and effective management of these agroecosystems. To this end, it is important to understand their operating system and to promote effective management strategies.

- Ecosystems and the concept of biodiversity

  In the inland valleys, we find animals and plants which exist in relation to each other. This group of animals and plants together with the inland valley itself is called an ecosystem. Animals and plants constitute biodiversity.

- Inland valley operating cycle (ecological system)

  The operating cycle of a typical ecological system is illustrated by the following image:



Operating cycle of a living environment and food chain [3]

The inland valley ecosystem functions as follows:

- The water from the uplands is loaded with organic matter and collects in the inland valleys. Under the effect of sunlight, water and CO2, inland valley plants capture mineral salts for their growth. (A)
- Part of the vegetation is consumed by herbivorous animals. Dead plants and herbivores accumulate on the floor of the inland valleys as litter. (B)
- Decomposers (earthworms, fungus) break down the organic matter realeasing nutrients into the soil. (C)
- The nutrients thus released into the soil represent the richness in fertility of the inland valleys and have real potential for agriculture. (D)
- The nutrient cycle helps support life in different forms, hence the availability of nutrients to other users.

The food pyramid and the consequences of breaking the chain

In the food pyramid, every living thing eats what comes before it. Elimination of snakes leads to the proliferation of rats (which are located below the snakes in the food pyramid). This will cause the destruction of vegetation (and therefore crops, in agricultural areas) due to the multiplication of rats in the field, because vegetation is located below the rats in the food pyramid.

Likewise, the destruction of decomposers (earthworms, fungus) will prevent the decomposition of dead matter which comes from plants, herbivores (rats) and carnivores (snakes).

Thus, the nutrients that plants need for food cannot be released into the soil. The plants will then no longer be able to establish themselves in the environment. The balance is thus upset. This leads to the degradation of the environment

Strategies for promoting the sustainable management of inland valley species

The plant and animal species of the inland valleys vary from one environment to another. The exploitation of inland valleys for agriculture must also safeguard biodiversity so as not to damage the ecosystem.

Thus, to sustainably exploit these environments, farmers must:

- have information on the usefulness of the various animals and plants existing in the area;
- fully protect part of the inland valley (an area strategically rich in plants and animals that can be considered the core of the inland valley) to preserve the flora and fauna and their functions.
- create corridors between fully protected areas;
- practice agricultural diversification in the remaining areas;
- reduce the use of agrochemicals as they accumulate in the soil and pollute water.

An inland valley before its development [4]

Sustainable agricultural production in an inland valley

To keep the inland valleys productive over the long term, it is important to preserve the balance of the ecosystem:

Harmful actions to avoid

- Avoid destroying all the vegetation in the area.
- Reduce and rationalize the use of pesticides or chemical fertilizers because if they are misused, they threaten the survival of animals and soil microbiology. They can also be a source of contamination and pollution of inland valley water.
- Avoid heavy water control installations (development with flood spreading bund without drainage channel).
- Avoid monoculture which is often linked to an unreasonable use of agrochemicals.

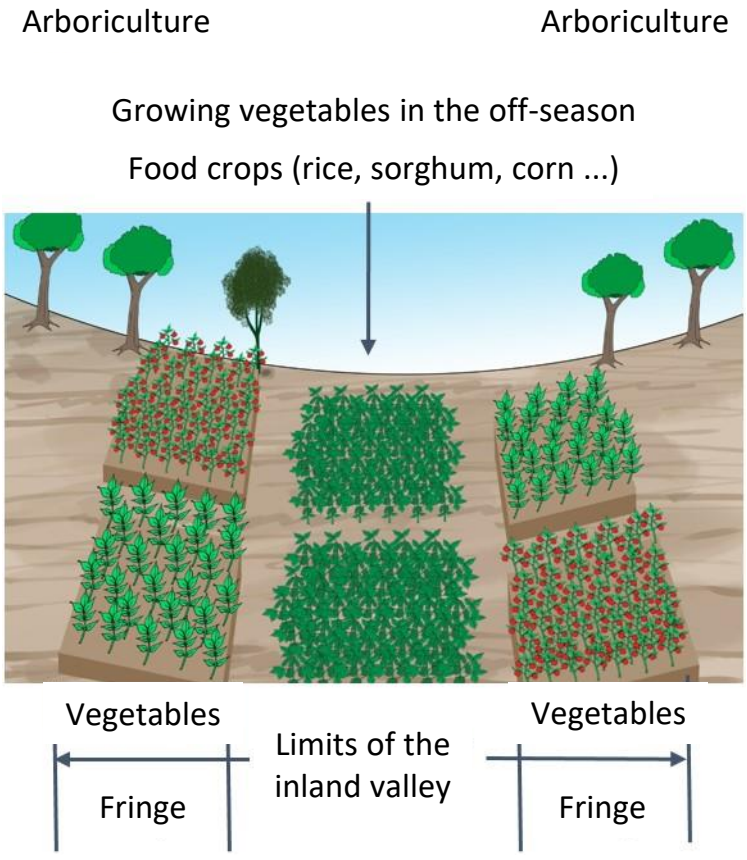
Favorable actions

Several practices allow the development of agriculture in inland valleys while respecting the environment:

- Use the natural topography and the natural flow axes of rivers to control water.
- Identify an area representative of biodiversity and conserve it in its entirety to maintain a balanced ecosystem.
- Create corridors between protected areas for the passage of animals between them.
- Set up a system of crop rotation and diversification.
- Use natural pesticides to effectively fight against pests and crop pests:
    - For example, use Gliocladium catenulatum (a fungus) against diseases caused by Botrytis cinerea (a fungus responsible for gray rot) on peppers, tomatoes, lettuce.
    - Also, use neem oil against powdery mildew on cucurbits (plant family: squash, zucchini, cucumbers, melons, watermelons, etc.) and septoria (a fungal disease) on tomatoes.
    - Sulfur can also be used against powdery mildew on inland valleys vegetables.
    - Neem is also used against insect pests on crops: caterpillars, crucifers, leaf beetles, aphids and leafhoppers.

- Practice arboriculture at the fringes of the inland valley. Indeed, trees planted in this area will produce organic matter (dead leaves and roots) which will enrich the inland valleys after decomposition. They will also limit soil erosion and maintain the balance between the plateau and the inland valleys.

    - The fringe zone is very favorable for market gardening because it benefits from the humidity of the inland valley, without flooding, and constitutes a transition to the latter. Market gardening in the fringe area provides farmers with agricultural products during inland valley flooding. Likewise, the dead materials from this area will enrich the inland valleys. Arboriculture in this area not only ensures food security but also enriches the inland valleys with nutrients.



Developed inland valley zones [3]

Crop diversification

Monoculture or crop diversification?

Monoculture is the cultivation of a single plant species at the level of a farm, a planted forest, or region. In agriculture, crop diversification designates the plurality of agricultural crops on a plot, a set of plots or a farm.

Example of monoculture: a rice field [1]

Example of crop diversification: a garden with several kinds of crops [5]

Advantages and disadvantages of monoculture

Benefits

Monoculture allows farmers to focus exclusively on a single crop to maximize yield and profit. Harvesting is easier. But this approach is less sustainable and has several drawbacks.

Disadvantages of monoculture

Apart from the advantages of monoculture, it has real drawbacks. It:

- eliminates animal or plant species that enrich the soil;
- depletes the soil of its nutrients;
- destroys the nutrient cycle;
- requires the use of chemical fertilizers;
- promotes the multiplication of pests;
- therefore increases attacks on crops by diseases and pests;
- and requires the application of high doses of pesticides.

Symptoms caused by insects and diseases on the rice plant:

Symptom - rice yellow variegation virus [6]

Lepidoptera "dead heart" symptom stem borers [6]

Symptoms on rice leaves affected by blast [6]

Advantage of crop diversification (polyculture)

Benefits of crop diversification for agriculture:

- conservation of habitats for biological soil activity;
- considerable reduction in susceptibility to diseases;
- decrease in pest pressure;
- facilitation of biological control:
  - which therefore promotes the reduction of costs associated with the use of chemical inputs and pesticides;
  - and reduces the risks associated with the contamination of foods by synthetic pesticides;
- improvement of the nutrient cycle, protection and fertilization of the soil;
- reduced risk of environmental contamination due to overuse of fertilizers.

  This is possible thanks to the combination of certain plants rich in nitrogen (legumes) and especially in potassium (lettuce, cabbage) with plants less rich in these nutrients. The latter take advantage of nutrients to increase their development. Thus, the farmer no longer needs to add as much chemical or organic fertilizer, and the risk of environmental contamination is therefore reduced.
- all this enables improvement to the peasants standard of living.

Benefits of crop diversification (polyculture) for nutrition:

- healthy and quality products;
- reduced risk of significant crop loss due to pests and diseases;
- and therefore better food security.

Exploitation of legumes :

they enrich the soil with nitrogen and prevent soil erosion when used as a cover crop (peas, mucuna, soybeans, cowpeas, peanuts, beans, pigeon peas).

Soybeans [7]

Peanuts [8]

Pigeon pea [9]

Socio-economic benefits of polyculture:

- it reduces the costs associated with the use of synthetic chemical inputs and certain techniques (tillage, slash-and-burn, weeding, etc.).
    - This is the case, for example, with cabbage and carrots sown in combination: the different types of plowing, the crushing of large clods of soil, loosening, the making of beds, fertilization based on organic fertilizers if possible are done all at once for both crops. The cabbage is then placed in the nursery for as long as it takes. Then a row of cabbage is transplanted in the middle of a bed and three rows of carrots are sown directly on each side (an example).
    - Both need a lot of water at first: carrots to germinate, cabbages to grow well, but also to control flea beetles. All other maintenance operations are carried out simultaneously for both crops. This is a major saving in time and a huge reduction in the work to be done previously. It gives the possibility of a better valuation of agro-agricultural products. The example of cabbage and lettuce also shows a typical picture of this reduction in loads.
- it promotes sustainable agriculture and improves the living conditions of the population.

Benefits of crop diversification for the environment

For the environment, the diversity of crops has the following advantages:

- reduction of agricultural and environmental pollution;
- the erosion control;
- maintaining ecological balance.

Soil erosion [10]

Polycultures practicable in the inland valleys

crop diversification enables sustainable and economical agriculture. For the development of the inland valleys, crop diversification must be promoted. For this purpose, several cropping systems can be practiced.

Crop rotation (with nightshade for example)

This works in combination: growing rice in the rainy season, market gardening (nightshade in our case) in the dry season. Since inland valleys are water-retaining environments, the farmer can create water collection channels (artificial wells) or bunds in the rainy season to ensure continuous watering of crops in the dry season. However, the workload can be reduced by establishing crops with very low water requirements such as cucumber and chili. Although watering is still necessary at times. The ground hardens and water no longer flows normally due to the annual flooding. It is therefore necessary to select the types of vegetables accordingly. As an example of a rotating system, we can have: "rainy season: rice growing, dry season: nightshade".

Mixed crops

In this case, there is a combination of different crops (leafy vegetables or fruit vegetables). This helps fight against diseases and harmful insects. Illustrative examples are: “tomato (nightshade, fruit vegetables) + carrot + (umbelliferae, root vegetables) + onion (liliaceae, bulbs) + cabbage (cruciferous, leafy vegetables)”.

Mixed culture [5]

Conclusion

The inland valleys are very rich environments for agriculture (market gardening, arboriculture, rice production, sorghum, sweet potato, cowpea) and they constitute important sources of income for improving the living conditions of the population. They are also complex and fragile environments, and their development requires technical guidance to guarantee their lasting balance and function.

Integrated management of rice diseases, pests and weeds

Biological control, sustainable or integrated control?

The concept of integrated management with examples

Integrated management is a mode of managing certain agricultural activities which integrates at least two activities, two methods or two approaches, from the design phase. It takes into account all the associated ecological, economic and social factors. It aims to optimize actions to achieve balanced management.

Example of integrated management of a farm: it combines animal husbandry with food production and industrial production.

Example of integrated insect management in a rainfed rice field - it combines:

- the choice of resistant or tolerant seeds
- good farming practices such as
- sowing early and sowing early maturing varieties of rice
- plowing wet soil after the first rains
- broadcasting or sowing in furrows rather than in clumps, as plants are better protected against soil insects
- practicing intercropping which in some situations can reduce pest damage to rice.

Vegetables in general and legumes can be cultivated as an intercropping crop, but only in irrigated or water-controlled inland valleys.

Sustainable control

This is about applying a method to a reasonable extent. Once the problem has been identified, the appropriate product or approach must be determined. Then the right dose or effort must be applied with the right device at the right time.

It is therefore a question of protecting the environment, but also the resources used, which the farmer must find to solve the problem.

Biological control

Biological control is a method of controlling pests without chemical pesticides. It involves using antagonistic living organisms called biological control agents or auxiliaries against crop pests (insects, mites, nematodes, etc.), diseases (fungal, bacterial, viral, etc.), or weeds (weeds).

These agents are either predators, parasitoids, pathogens (viruses, bacteria, fungi, etc.), herbivores (or phytophages).

It requires a good knowledge of diseases and pests, both from the point of view of recognising them, and understanding their biological cycle. Its purpose is to keep the populations of bio-aggressive organisms below a threshold of harmfulness.

There are three methods of biological control:

- the first is classic and consists of the acclimatization of natural enemies imported or introduced into a new environment - we talk about 'inoculative releases';
- the second, called augmentative or 'flooding' biological control, consists of repetitive treatments or releases of auxiliary agents;
- the third is that of conservation which consists in the promotion of existing auxiliary agents.

The control of harmful insects

Many and diverse insects can attack rainfed and irrigated rice. The damage they cause is sometimes significant enough to justify intervention by the farmer. These are stem borers, defoliators, biters and grain suckers and soil insects (termites, ants, mole crickets, grubs and black mealybugs, root beetles, root bugs and moths, etc.).

There are different methods to control these insects. It is strongly recommended that you first give priority to natural methods through the choice of good quality seeds, good farming practices, the promotion of plants that harbor useful insects such as, for example: Paspalum scrobiculatum or sword grass.

Moreover, colorful flowering plants should be favored around rice fields because they attract beneficial insects, especially parasitoids, predators and pollinators.

In general, the fight against (rainfed) rice insect pests is carried out in various ways: by the use of resistant or tolerant varieties, by good farming practices, by the use of natural or auxiliary enemies and by the use of chemicals.

Stem borer Lepidoptera Chilo zacconius [6]

Sword grass [11]

Some examples

The use of resistant or tolerant varieties

Some varieties are resistant to borers because of their physical characteristics (thick and lignified tissues, rich in silica) or chemicals (substances more or less toxic to the insect).

The adoption of resistant varieties is a particularly interesting solution for the farmer since it does not require any additional work on his/her part, nor investment in products or processing equipment. New increasingly resistant varieties are being researched in agricultural research centers and institutes.

Good farming practices

To be effective, the control of rainfed rice pests lies in following certain good farming practices within a well-defined area based on the decisions of the group.

- Sow early and sow early maturing varieties of rice. This can help protect plants from minor diptera, white grubs, etc.
- Plow the wet soil after the first rains. This brings insects to the surface which will then be destroyed by birds, poultry, dogs, etc. Plowing immediately after harvest produces better results.
- Broadcast or sow in furrows rather than in clumps, as plants are better protected against soil insects. In the case of pocket sowing, the seeds are easily damaged by foraging insects, rodents and birds.
- Practice intercropping which in some situations can reduce pest damage to rice. Pests that feed on the aerial part of the plant such as shoot aphids, leaf beetles, stem miners, and grasshoppers may have difficulty proliferating in intercrops.

View of a broadcast rice field [12]

Other farming practices, such as the application of fertilizers and mulching, have an effect on the populations of certain insect species. This is because increasing nitrogen levels by adding NPK to plants can increase the insect populations that live there.

On the other hand agricultural methods using organic soil amendments such as mulching considerably favor the conservation of arthropod species in all functional groups. They also contribute to the abundance of natural enemies that control pests, compared to conventional practices.

Before making a decision on farming practices, all of these must be carefully considered if the insect pest population is to be kept as low as possible.

Chemical control

Insecticides are rarely used on upland rice because they are too expensive compared to the low productivity of this crop. However, with the improvement in the productivity of upland rice and the need to contain epidemics, the use of insecticides may be justified.

Seed treatment is not only inexpensive, but also effective in controlling minor diptera, ants, termites, etc. However, it is ineffective against white grubs.

The stages of seed preparation:

1. Soak to remove floating seeds (empty seeds and other waste).
2. Dry good seeds in the shade for 2 to 3 hours.
3. Perform the germination test with the support of an agricultural advisor, one month before the sowing date.
4. Choose approved treatment products with the support of an agricultural advisor.
5. Treat the seed 1 to 3 days before sowing.

Likewise, baits are used against ants, lesser diptera, mole crickets and field crickets. Baits, impregnated with insecticides, can be easily prepared with local equipment. Spray formulas are also used in only by rain irrigated crops to control leaf pests.

Use chemicals only if other control methods have failed.

Chemical control practices against rainfed rice insect pests

- The list (Table 1) on the following page is taken from an FAO document
- The choice of insecticides may not apply to all countries
- The chemicals were valid until the date of publication (1997)
- However the list gives you an indication of the active ingredient. Find out what the latest insecticides with these ingredients are.
- Only chemicals registered by the government can be used locally, and only by strictly following the recommendations of the ministry and the manufacturer

Chemical control in an inland valley [3]

Table 1. Chemical control practices against upland rice insect pests [I]

Insects	Means of control
Ants, termites, grubs, black mealybugs	Seed treatment with carbofuran, chlorpyriphos @ 0.5-1 kg / 100 kg of seeds
Rice hesperids, leaf moths, gall gall midge, green horn caterpillars, stem borers, locusts, mealybugs, thrips, moths	Foliar spray with chlorpyriphos, dichlorvos, phosphamidon, monocrotophos @ 0.3-0.4 kg a.i./ha
Leafhoppers, delphacids	Foliar carbaryl spray @ 0.3-0.4 kg a.i./ha directed at the feeding point

Table 2. Other non-chemical methods [II]

Targeted pest	Type of method tested	Notes	References
Termites, stem borers	Jatropha oil, neem oil or powder, neem cake	Mali: Producer Preferred Neem Oil	Nwilene et al., 2008
Termites	Tobacco powder (moistened)	Along the seedling lines	Nwilene, 2010
Termites	Bamboo cuttings, dried corn stalks	Trap plants	Nwilene, 2010
Termites	M. anisopliae (fungus)	Necessity of additional cost	Togola et al., 2012
Stem borers	Strip crops (maize-cassava)	From local practices (+/-)	Nwilene et al., 2011
Sitophilus oryzae	Seed treatment with P. guineense black pepper powder @ 0.50 to 2.5 g of powder per 100 g of seeds	Lab experiment	Pegalepo et al. 2019

Example of an application of neem oil:

- 2 liters of neem oil + 1 liter of water + 10 g of soap ("OMO" type or other)
- 10 liters of water are added to 1 liter of the concentrated solution before application to the field
- The mixture is applied (15 liters / ha) between the pockets 25 days after sowing, then every 20 days until maturity

Neem seed oil [13]

Neem oil + water + OMO [13]

Rice disease control

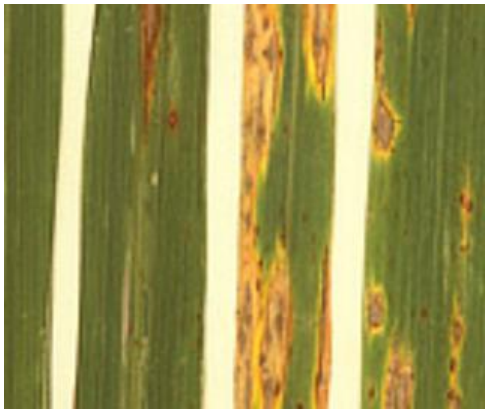
Diseases of rice are mostly caused by fungi, bacteria, viruses and nematodes. The symptoms depend on the reaction of the plant, the age of the organ attacked or the variety.

Some examples of possible diseases and control methods

Blast

By far the most dangerous disease is rice blast caused by Pyricularia oryzae. It often affects the aerial organs (leaves, stems and panicles), but can affect all the organs of the plant: leaves, necks, rachis, nodes of the stem, grains. When this disease attacks the neck of the panicle, it blocks the migration of the nutrients necessary for the filling of the grain. This disease is favored by the use of high doses of nitrogen or high air humidity for 7 to 9 hours.

Symptoms of blast on knots of rice stems [14]



Lesions on rice leaves affected by blast [15]

Blast control - farming practices

- Use healthy and undamaged seeds.
- Remove and burn contaminated plant debris.
- Remove other host plants and wild rice.
- Practice crop rotation as much as possible.
- Plan the sowing of rice so that adverse weather conditions for the disease coincide with vulnerable stages of plant growth.

Rice helminthosporiosis

Considered the most important fungal disease that occurs in rice, this disease is caused by Dreschlera oryzae. The lesions are localized on the leaves and vary from brown mottling to an oval lesion. They are distributed over all the leaves. This disease is mainly linked to unfavorable soil conditions and the use of infested seeds.

Helminthosporiosis control - farming practices

- Use healthy and undamaged seeds.
- Optimize soil fertility.
- Remove and burn infected plants or parts of plants.
- Time rice planting so that the sensitive stages of plant growth coincide with adverse weather conditions for the growth of pathogens.
- Remove possible hosts, such as Setaria sp., Leersia sp., And Echinochloa sp.

Setaria italica [16]

Echinochloa crus-galli [17]

Bacterial leaf wilt

Bacterial wilt of rice leaves caused by Xanthomonas oryzae pv. oryzae is one of the most common rice diseases in the world. On seedlings, wilt first appears as a small wet spot on the periphery of fully developed lower leaves. As the spots enlarge the leaves turn yellow, dry and wither. On the limbus, lesions usually appear on the edges of the tip and enlarge with a wavy outline, then turn yellow and dry. The areas adjacent to the healthy parts are soaked.

In heavily contaminated fields, grains can also be affected and the disease manifests itself on the glumes as discolored spots surrounded by a wet margin.

Bacterial leaf wilt control - farming practices.

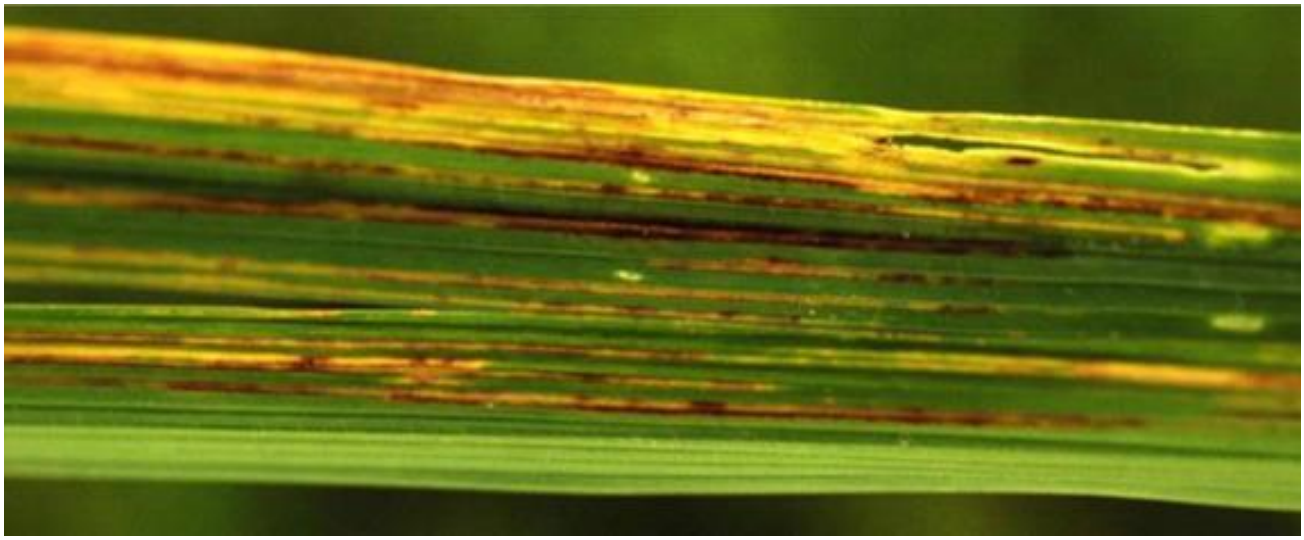
- Use healthy, undamaged seeds.
- Suppress host weeds like Leersia sayanuka, L. japonica, L. panacea, Zizania latifolia, etc., which are an important source of primary inoculum.

This is another example of the Leersia weed type - these types are very similar to cultivated rice [18]

- Remove and burn contaminated straws.
- Practice crop rotation as much as possible.
- Apply only the optimum level of fertilizer, as higher doses of nitrogen predispose the plant to contamination.
- Plan rice planting so that weather conditions unfavorable to the development of pathogens coincide with vulnerable stages of plant growth.

Bacteriosis of translucent streaks

In the early stages of the disease, the striae are 0.5-1 mm wide and 3-5 mm long; they are longitudinal, dark green in color and have a moist translucent appearance. The disease is usually confined to the spaces between the large veins, but may, when spread laterally, cross them. Bacterial ooze appears on the surface of the lesions under moist conditions and dries up after forming very small yellow drops which are often numerous on linear lesions. High temperatures have been found to be conducive to the spread of this disease.



Leaf symptoms [19]

Disease control - farming practices

- Use healthy and undamaged seeds.
- Remove and burn contaminated plant debris
- Remove other host plants and wild rice.
- Practice crop rotation as much as possible.
- Plan the sowing of rice so that adverse weather conditions for the disease coincide with the vulnerable stages of plant growth.

Weed control

A weed is a plant that grows in a place where it is not wanted.

Preventive control - cropping techniques:

- Soil preparation
- Transplanting
- Irrigation water management (cover weeds with a 2-10 cm water depth)
- Stocking density
- Crop rotations
- The use of clean seeds

Curative control

- Weeding: manual (slow and painful), mowing (slow)
- Mechanical weeding (possible if sowing or transplanting in lines, on drained soil), plowing at the end of the cycle

Mechanical weeding with a weeder [20]

- Chemical weed control (herbicide use)

Herbicides are also used to control weeds. There are three types:

1. pre-emergence herbicides (Simazine, Atrazine, Diuron)
2. contact herbicides (nitro dyes, Diquat, Paraquat)
3. systemic herbicides (2,4 D, Dalapon, Aminotriazole)

Use in Benin

In Benin, according to the information collected from a few producers and supervisors of rice farmers, infestations of fields by various groups of insects are quite low or modest and do not require the major use of insecticides. Rather, herbicides are often used for the control of various rice weeds.

We can cite :

- Penoxsulam 2 (5G / L OD) agrochemical herbicide - a selective post-emergence herbicide for irrigated and rainfed rice
- Garil Power EC (Cyhalotop-butyl 184.3 g / l + Fluroxylpur-meptyl 230.7g / l) - post-emergence rice herbicide
- Top Star 400 SC (Oxadiargyl 400g / l) - rice herbicide
- DEKAT-D720 SL [2.4-D Dimethylamine salt 720 g / l]: herbicide against dicotyledonous weeds of rice

Always check with your country's Ministry of Agriculture which products are registered, as these products change depending on the country and the year!

The consequences of excessive application of pesticides

On the environment

The dangers of pesticides on the environment are numerous. In addition to killing the target species, they can also easily contaminate and kill other actors in the food chain. Birds, for example, are very often affected by pesticides by eating contaminated insects. In addition, pesticides pollute the air we breathe, and can also pollute water supplies to the point of making them unsuitable to drink from.

About health

The current list of the health consequences of pesticides is not exhaustive, but many dangers are already known. Even with low exposure, pesticides can have serious consequences on the body, such as causing respiratory genes, headaches, skin irritation, male infertility, cancer, digestive, mental and behavioral disorders. They can also seriously damage the unborn child.

Pesticides can indeed cause spontaneous abortions or serious fetal malformations. Many cases of acute pesticide poisoning, sometimes fatal, have also already been detected in agricultural areas, where exposure to pesticides is greatest.

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Source of images

[1] Photo provided by AfricaRice
[2] Illustrations taken from "Defoer, T, Dugué, M-J, Loosvelt, M, and Worou, S. 2017. Smart-valleys: Trainer – facilitator manual. Abidjan, Ivory Coast: Africa Rice Center (AfricaRice). 130 pp. "
[3] Illustration produced by EUDOX BÉATITUDES
[4] Photo provided by Sokou Worou
[5] Photo provided by Christian ADJALLA
[6] Photos: PLAR – IRM Curriculum: Technical Manual (Wopereis et al., 2009)
[7] https://fr.wikipedia.org/wiki/Soja#/media/Fichier:Plante_de_Soja_-_Feuilles_et_fruits.jpg
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[11] https://fr.wikipedia.org/wiki/Paspalum_scrobiculatum#/media/Fichier:Paspalum_scrobiculatum_(4987845638) .jpg
[12] Photo provided by Mr Toulou, Zogbodomey / Benin
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[20] Extract from the following AfricaRice video: https://www.youtube.com/watch?v=w7PQhY0DKh0

Source of tables

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[II] Sylvie et al. 2012. Non-chemical methods for the control of rice insects in Africa. 1st International Conference. Organic rice production systems, Montpellier, France, August 27-30, 2012