

Pack 115, Item

Type: Backgrounder

2020

# \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Backgrounder: Fires deliberately set for agriculture, their impacts and alternatives** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Introduction**

Today, soil degradation is occurring in most parts of Africa. This manifests in the impoverishment of agricultural land, the destruction of forests, soil erosion, and other impacts. Human activities have played a part in this. For example, certain agricultural practices such as deliberately-set fires have a negative impact on soils and the general environment.

However, there are alternatives to fire for sustainable and environmentally-friendly agriculture.

**Why talk about this subject?**

The consequences of deliberately-set agricultural fires include:

* Loss of organic matter from the soil
* Intense evaporation and depletion of soil moisture
* A decline in soil fertility
* An increase in soil erosion
* (If the fire gets out of control), destruction of large areas of forest and other resources.

Talking about the impacts of agricultural fires makes farmers aware of the harmful effects of the practice on the environment and thus on their survival.

**Some key facts about fires deliberately set for agriculture**

1. **Expected impact on cropland**
* *Loss of soil organic carbon*: Declining soil organic carbon affects soil fertility and the soil's ability to moderate the effects of climate change by retaining carbon in the soil.
* *Loss of soil biodiversity*: a decrease in the diversity of micro and macro-organisms in the soil. This reduces the capacity of the soil to provide essential ecosystem services such as retaining organic carbon and cycling nutrients.
* *Soil erosion*: the removal of topsoil from the earth's surface. In the first few weeks after a fire, the risk of erosion can be very high because of the lack of vegetation cover. Steep slopes and heavy rainfall increase the susceptibility of land to erosion.
* The warmer the climate, the drier the vegetation gets and the more likely it is to flare up, the result of a combination of phenomena, including heat, low humidity, low rainfall, and often strong winds.

1. **Key information about fires deliberately set for agriculture**

Burning crops is a custom which many farmers adopt to clear land for farming and to clear crop residues after harvest or before planting. Farmers often use the practice because they think it is the only or the best solution to soil fertility and weed management.

**Impact of farm fires**

*1. Impact of agricultural fire on natural vegetation*

* Decline or disappearance of vegetation cover
* Loss of density of vegetation and of biological diversity
* Soil degradation
* Loss of pasture

*2. Impact of agricultural fire on soils*

* Soil erosion
* Desertification
* Lower crop yields
* Loss of topsoil
* Reduction or loss of soil fertility
* Decline in agricultural production
* Loss of soil micro-organisms
1. *Impact of agricultural fires on humans*
* Food insecurity
* Loss of species used in traditional medicine

**Good alternative practices to fires set by farmers**

1. **Planting fertilizer trees\***

One option is “fertilizer trees.” A fertilizer tree is a species whose activity enriches the arable layer of the soil, improves its texture, and promotes good soil structure. The purpose of planting fertilizer trees is to make fields self-sufficient in nitrogen. They fix atmospheric nitrogen and enrich the soil by transforming it into compounds that can be more easily assimilated by plants.

In order to effectively perform their function in fields, they must not compete vigorously with crops grown for domestic use or commercial production.

*How can planting fertilizer trees replace agricultural fires?*

For farmers, burning residues results in a flush of nutrients from deposition of ash on soils. This can improve yields during the season after burning. But soil productivity declines over time because soil nutrients and soil micro-organisms are depleted.

Fertilizer trees are a natural and inexpensive technique for enriching the soil.

*For more information, see documents 3, 9, 13, 15, and 17.*

# Fast-growing legumes used as green manures/cover crops (gm/cc)\*

Integrating legumes into farming systems enables small-scale farmers with few resources to improve the long-term fertility, health, and resilience of their soils. It enables farmers to enrich their land without using agricultural fires. However, the success or failure of this practice depends to a large extent on choosing suitable legumes.

What are gm/cc?

Gm/cc (green manures/cover crops) are crops grown to cover and improve the soil and produce beneficial effects on crops. Many plants, for example those belonging to the *Fabaceae* family (legumes, peas, and beans) can be used as gm/cc. In symbiosis\* with specific soil bacteria, legumes can convert atmospheric nitrogen into "fixed" nitrogen that plants can assimilate. This process is called biological nitrogen fixation.

*How do you grow green manure crops?*

It is recommended that green manure crops be planted in furrows, or lightly incorporated into the soil. If the seed is left on the surface, germination will be greatly reduced, especially if it does not rain within a few days.

Where an intercrop cover crop of a cereal such as sorghum or millet is established, Guinea grass\*, brachiaria\* or *Stylosanthes guianensis*\* may be used.

These species must be carefully intercropped with food and fibre crops. Competition between crops and brachiaria can be avoided in various ways, for example by:

* Growing brachiaria on a different time frame than the main crop.
* Planting brachiaria seeds deep enough (4-7 cm) to delay emergence.
* Adapting the spacing between the crop and brachiaria.
* Applying fertilizer at the base of the crop to favour it over brachiaria.
* Regularly cutting brachiaria.

*How can green manures and/or legumes replace agricultural fires?*

Farmers who use fire in their fields argue that burning reduces pest invasions after planting, and helps them control weeds.

Green manures are cover crops that increase soil organic matter, thereby improving overall soil fertility. They suppress weeds, either directly (by blocking light), or indirectly (through a process called allelopathy.\*

Green manures enrich the soil with nitrogen and other nutrients. They also contribute to the formation of soil organic matter and humus.

Cover crops have additional benefits that vary depending on the species. For example, legumes enrich the soil with nutrients, while cover crops with deep roots break up compacted soil.

*For more information, see documents 4, 5, 10, and 12.*

1. **Silviculture (agroforestry) / agro-silvopastoral system**

This involves the introduction of fertilizer or forest trees into farmers' fields, through reforestation or by applying natural regeneration techniques (see FMNR below).

To obtain good results with this technique, farmers must take a number of criteria into account:

*Choice of plants*

* Exclusive use of indigenous plants that are well-adapted to local conditions.
* Select species according to the location (e.g., soil type, moisture, sunlight) and the functions it will perform (e.g., as a windbreak, a hedge, to fix nitrogen, to provide shade, etc.)
* The planting of disease-susceptible species should be restricted to avoid spreading disease to healthy plants.

*Site selection*

* Prioritize sites that are connected with biodiverse areas (e.g., orchards and meadows).
* The location of a hedge should be carefully chosen to meet the specific objectives of the hedge and not interfere with other farm functions.

Each fertilizer tree fertilizes (from the third year after planting) an area up to five metres from the tree. Also, falling leaves cover the surface of the soil as the tree grows. These leaves fall, accumulate, degrade, and form humus, while tree roots bring nutrients up from the depths of the soil.

Agroforestry fields and rotating agroforestry pastures are important because:

* They reduce soil erosion.
* They enhance soil fertility by fixing nitrogen.
* Fertilizer trees contribute to the reduction of greenhouse gases because they retain carbon.

*For more information, see documents 8, 11, 16, 18, and 21.*

1. **Farmer Managed Natural Regeneration (FMNR)**

Farmer managed natural regeneration is an agroforestry technique practiced especially in arid or semi-arid zones to reforest land whose trees have been cut down. It requires very little equipment or investment and no irrigation.

The principle of FMNR is selecting the most favoured stem of a stump, often the strongest and straightest one. The other stems and side branches are then cut down to allow growth to accelerate in the remaining stem. Managing regrowth involves periodically eliminating lateral branches to keep only a few main stems.

*How to practice FMNR?*

Essential steps include:

* Identifying and selecting the stems to be protected.
* Cutting non-selected stems and side branches.
* Maintaining and pruning selected stems every year.
* Reasonable usage of branches from regenerated trees based on the species and need (as fodder, wood, organic matter, etc.).

One advantage of FMNR is increased yields. Once stems have regrown and falling leaves and animal dung have nourished and enriched the soil, crops can be planted near regenerated trees.

Another advantage is that after a number of years of regrowth, large trees prevent the wind from lifting and carrying dust, thus blocking desertification and protecting crops from wind.

*How can FMNR replace agricultural fires?*

For farmers, burning residues is thought to improve yields by managing weeds and improving fertility.

FMNR provides these benefits without the long-term degradation associated with agricultural fires, and provides other benefits, including improving long-term soil fertility and protecting crops from erosion.

*For more information, see documents 8, 11, 16, 18, and 21.*

1. **Producing compost from unused plant biomass**

Compost is a keystone of soil fertility. By recycling waste from the field and the kitchen, compost returns the elements that plants need to the soil.

If fields need fertilizer, compost is an ecological and economical solution to this need.

*How can producing compost from plant biomass replace agricultural fires?*

Nutrients that are released after burning are often swept or washed away by rain or eroded by wind. Soil productivity declines after continual burning because soil nutrients are depleted.

Compost is a free, natural fertilizer when it is homemade. It promotes and improves the fertility of your field and improves soil structure.

*For more information, see document 7.*

1. **Crop rotation**

Crop rotation involves alternating crops (cereals, legumes, oilseeds, etc.) over time on the same plot. In crop rotations, legume crops often help maintain or improve soil fertility and increase yields.

*How can crop rotation replace agricultural fires?*

One reason that farmers burn crops is to reduce pest populations before planting, including by destroying weeds that might attract pests.

Burning also destroys many weed seeds, and provides ash that is rich in potassium and calcium. This can add value to the soil and benefit the crop, at least in the short term.

In many types of agriculture, rotating crops is a key practice for maintaining soil fertility and controlling weeds. It also reduces the buildup of insect population and disease incidence, manages weed populations, maintains soil fertility (especially if legumes are included in rotations), and improves yields.

*For more information, see documents 2 and 19.*

1. **Maintaining vegetation cover with mulch**

Mulching is covering the soil with various materials.

The purpose of mulching is to protect crops from the weather and prevent weed development. Organic mulch, as it decomposes, also enriches the soil.

*How can mulch replace agricultural fires?*

Farmers argue that burning kills pests and disease-causing organisms in the soil. This is true, but it also kills beneficial and important organisms and reduces biological activity in the soil. Mulching, on the other hand, improves the soil by attracting and feeding earthworms and other living organisms. These organisms "plough" the soil and their excreta are among the best fertilizers and soil conditioners.

### Feeding the soil

### Organic materials used as mulch, especially those that decompose easily, will be absorbed, digested, and finally transformed into nutrients available for crop plants, by organisms living in the soil.

*Limiting the growth of weeds*

### A thick soil cover chokes off weeds and thus prevents their proliferation in the field.

### Some particularly virulent weeds (quack grass, bindweed, dock, etc.) will manage to pass through the mulch. But they can then be pulled out much more easily than on bare soil.

 *For more information, consult documents 6 and 20.*

**Key definitions**

*Agroforestry:* Practices that combine trees, crops, and/or animals on the same agricultural plot, either on the field edge or in the open field. These practices include agro-silvicultural systems but also silvo-pastoral systems (animals grazing under fruit orchards).

*Agro-sylvo-pastoral system: The combination of pastoralism and agriculture in a forest environment.*

*Allelopathy:* The chemical inhibition of one plant by another, due to the release of substances that inhibit germination or growth.

## Biomass: All organic matter of plant or animal origin.

*Compost:* The remains of the decomposition of organic matter (manure, plants, animals). Composting is an operation during which organic waste decomposes under controlled conditions, in the presence of oxygen and water, by the actions of bacteria, fungi, and other micro-organisms. All organic waste can be composted: kitchen waste, field residues, and household waste.

*Carbon dioxide (CO2):* An important greenhouse gas that traps heat in the atmosphere. Greenhouse gases are released by human activities such as deforestation and burning fossil fuels, as well as by natural processes such as respiration and volcanic eruptions.

*Fertilizer tree*: A tree that enriches the soil and improves its texture and structure. Fertilizer trees are mainly from the legume family.

# gm/cc: Green manure/cover crops: plants grown to cover and improve the soil as well as to produce beneficial effects on other crops.

*Legumes:*A type of crop harvested to obtain dry grains (dry beans, lentils, peas). They “fix” atmospheric nitrogen in the soil and thereby increase soil fertility.

*Mulch:* Mulch or mulching is covering the soil with various materials in order to protect crops from bad weather and prevent weed development. The organic materials, as they decompose, also enrich the soil.

*Farmer-Managed Natural Regeneration (FMNR)*: Identifying, managing, protecting, and using regenerated shoots or stems.

*Silviculture:* The use and conservation of forests and forest products through afforestation, replanting, land clearing, and deforestation to maintain forests.

**Acknowledgements**

Contributed by: Alegnesy Bies, Media and Communications Specialist

Reviewed by:

**Sources of information:**

1. Botoni, E., Larwanou, M., and Reij, C., 2013. La régénération naturelle assistée (RNA) : une opportunité pour reverdir le Sahel et réduire la vulnérabilité des populations rurales, p. 153-162, dans Dia, A., et Duponnois, R., (dir.), Le projet majeur africain de la grande muraille verte, 2013. Read online at: <https://books.openedition.org/irdeditions/2122?lang=fr>
2. de Bon, H. et al, 2019. Rendements et pratiques des cultures maraîchères en agriculture. *Cahiers agriculture*, Vol 28(2). <https://www.researchgate.net/publication/331953376_Rendements_et_pratiques_des_cultures_maraicheres_en_agriculture_biologique_au_Senegal>

# Diatta M. et al, 2012. Rôles de la haie vive antiérosive sur la gestion de l’eau, du sol et le rendement des cultures du centre sud du bassin arachidier sénégalais, dans Roose, E. (éd.), et al, 2012. Lutte antiérosive : réhabilitation des sols tropicaux et protection contre les pluies exceptionnelles. <https://pdfs.semanticscholar.org/0cfd/8b08a3552bffce0512c4fda5b57a2e8c8257.pdf?_ga=2.14808690.577396097.1595362416-596393791.1595362416>

##### [ECHO, 2017.](https://www.echocommunity.org/fr/resources/08a2a7fb-2490-4d24-b303-43064fc99559) La sélection de légumineuses comme engrais verts/cultures de couverture. ECHO Pratiques Exemplaires (BPN), BPN #7. <https://www.echocommunity.org/fr/resources/38fc8ceb-988f-43bf-9ef3-d0cfd9fea169>

1. Ferreira, A. et al, 2013. *Les espèces végétales de couverture du sol destinées à la culture du coton en semis direct*. <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/142514/1/Les-especes-vegetables-de-couverture-du-sol....pdf>
2. Freud, X., 2005. *Evaluation de l'impact economiques de culture sur vegetal (SHV) au Brésil et à Madagascar*. CIRAD. <http://agritrop.cirad.fr/527511/1/document_527511.pdf>
3. Ganry F. et Badiane, A., 1998. La valorisation agricole des fumiers et des composts en Afrique soudano-sahélienne : Diagnostic et perspectives. *Agriculture et Développement* (18) : pp. 73-80. [https://agritrop.cirad.fr/390389/1/document\_390389.pdf&ved=2ahUKEwj3gMWloMLqAhWVtHEKHc8zDWAQFjAEegQICRAB&usg=AOvVaw3aHCat9hKqmPDRWoKZDDKr](https://agritrop.cirad.fr/390389/1/document_390389.pdf%26ved%3D2ahUKEwj3gMWloMLqAhWVtHEKHc8zDWAQFjAEegQICRAB%26usg%3DAOvVaw3aHCat9hKqmPDRWoKZDDKr)
4. Garrity, D. et Stapleton, P., 2011.L’agroforesterie, espoir d’une agriculture durable. *Revue Agridape*, volume 27(2). <http://www.iedafrique.org/IMG/pdf/Agridape_n27_2.pdf>
5. Hien F., et Zigani, G., 1987. *La haie vive : Un modèle d'intégration de l'arbre au système d'exploitation agricole et pastorale*. <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/8938/IDL-8938.pdf?sequence=1>
6. Hinimbio T. P., 2019. *Thèse : Réhabilitation de la fertilité des sols par usage des bioressources (Crotalaria juncea L. et Brachiaria ruziziensis G.&E.) en zone cotonnière de l’Extrême-Nord, Cameroun*. <https://tel.archives-ouvertes.fr/tel-02305183/document>
7. Humbert, P., 2016. Les arbres fertilitaires : base de l'agro-écologie en Afrique. *Grain de sel*, nº 63-66. <http://www.agrintalk.com/les-arbres-fertilitaires-base-de-lagro-ecologie-en-afrique/>

# Hunter L., 2020. Qu'est-Ce Que La Culture Intercalaire? <https://fr.ripleybelieves.com/what-is-intercropping-2562>

1. Levasseur V., Olivier A., et Niang. A., 2008. Aspects fonciers liés à l’utilisation de la haie vive améliorée. *Bois et Forets des Tropiques* 297(3) : 55-64.  [https://www.researchgate.net/publication/265380893\_Aspects\_fonciers\_lies\_a\_l'utilisation\_de\_la\_haie\_vive\_amelioree](https://www.researchgate.net/publication/265380893_Aspects_fonciers_lies_a_l%27utilisation_de_la_haie_vive_amelioree)
2. [Louari](https://www.mediaterre.org/membres/yendilofimba/) D., 2013. *La RNA (Régénération Naturelle Assistée), une technique utilisée au Burkina*. [https://www.mediaterre.org/afrique-ouest/actu,20130404010006.html](https://www.mediaterre.org/afrique-ouest/actu%2C20130404010006.html)
3. Mana Koudoussou, I.,2020, *Fiche technique de mise en place de haies vives avec* *Euphorbia balsamifera* (Kaguwa). <https://reca-niger.org/IMG/pdf/fiche_technique_haie_euphorbia_balsamifera_cra_zinder_2020.pdf>
4. Monot, J., 2017. *L'agroforesterie au secours de l'Afrique*. <https://news.all4trees.org/agroforesterie-secours-afrique/>
5. N’Guessan, K. A., et al, 2018. La haie vive, une technique durable et peu onéreuse pour protéger les cultures et terroirs ruraux. *Journal of Applied Biosciences* 127 : 12867-12873. Téléchargeable sur <http://agritrop.cirad.fr/588630/>
6. **Ndiaye M., sans date.** *La dégradation des terres au Sénégal : la réponse à partir des Arbres Fertilitaire*s. <http://www.iedafrique.org/La-degradation-des-terres-au.html>
7. OCDE /FAO, 2016. Perspectives agricoles de l’OCDE et de la FAO 2016-2025, Chapitre 2 : *L’agriculture en Afrique subsaharienne : Perspectives et enjeux de la décennie à venir*. [http://www.fao.org/3/a-bo092f.pdf&ved=2ahUKEwjhuKrkl8LqAhVMhRoKHU-vApcQFjAGegQIBRAC&usg=AOvVaw3pwp746NQ5\_SUdcVg-t0fQ](http://www.fao.org/3/a-bo092f.pdf%26ved%3D2ahUKEwjhuKrkl8LqAhVMhRoKHU-vApcQFjAGegQIBRAC%26usg%3DAOvVaw3pwp746NQ5_SUdcVg-t0fQ)
8. Penot, E., 2015. Le technicien propose, le paysan dispose. Le cas de l'adoption des systèmes de culture sous couverture végétale au lac Alaotra, Madagascar. *Cahiers Agricultures*, vol 24(2). [https://www.cahiersagricultures.fr/articles/cagri/pdf/2015/02/cagri2015242p84.pdf&ved=2ahUKEwiez56bmsLqAhUM6RoKHWsRCCYQFjAIegQICRAB&usg=AOvVaw3uypi4fD-3\_sj0sUAvROWW](https://www.cahiersagricultures.fr/articles/cagri/pdf/2015/02/cagri2015242p84.pdf%26ved%3D2ahUKEwiez56bmsLqAhUM6RoKHWsRCCYQFjAIegQICRAB%26usg%3DAOvVaw3uypi4fD-3_sj0sUAvROWW)
9. Pineau, W., 2008. *Guide agroforestier :* *Manuel de formation. Expériences de la périphérie du Parc National de Taï (MAB), Côte d’Ivoire*. <http://assets.fsnforumhlpe.fao.org.s3-eu-west-1.amazonaws.com/public/discussions/contributions/Guide_Agroforestier_RCI_Low_Def_1.pdf>
10. Rinaudo T., 2010. *Une brève histoire de la Régénération Naturelle Assistée : L’expérience du Niger.* <http://www.adaa-ase.com/documents/regeneration-naturelle-assistee.pdf>

*This resource was produced with the support of the Belgian Development Cooperation, Enabel, and the Wehubit program.*