

West Indian chickweed - *Drymaria cordata*

The control of weeds should allow maintaining plant species that are beneficial to the plantation and limit the development of weeds that compete with banana.

Cover crops or plants of service are plants associated to the plantation, which are used for their suppressive power on harmful weeds.

Preconceived ideas: “weeds systematically compete with bananas for fertilizer, water, and encourage the development of parasites (thrips, etc.)”.

► **Not necessarily! Some selected cover crops (selected in spontaneous flora, propagated from cuttings or sown) have low nutrient requirements, maintain moisture of the plot and can serve as refuge for beneficial insects that will control pest populations.**

Weed control can be achieved through the use of cover crops. It can also be mechanical or chemical.

1. COVER OR SERVICE CROPS

■ The IT2 and CIRAD are conjointly developing and evaluating “cover crops” or “service crops”. The main goal is to control weeds in order to reduce the use of herbicides. Several strategies tailored to different contexts and technical itineraries, are developed in partnership with producers to optimised the use of those plants properties.

■ During fallow period (cf. “Fallow management” sheet), service crops should:

- control weeds and monitor the population of nematodes (cover of non-hosts plants of main banana nematode, preventing the growth of weeds potentially host of nematodes),
- create biological porosity and restructure soil profile with a deep and powerful root system,
- maintain or improve soil quality by increasing organic matter ratio and promoting its biological activity,
- reduce erosion by rain and wind.

■ Biomass produced by these plants could be valued fodder.

■ Under established banana, a permanent cover has to be associated to the plantation. Cover crops selected and evaluated must:

- control weeds efficiently (service crops with quick installation and exclusives),
- not compete with bananas for nutrients and water,
- either be selected buyable cultivars (domesticated plants), or plants of local flora that can be naturally found in plots.

1.1- Domesticated cover crops in bananas

■ These plants are sown before or after banana implantation, generally in the wider row or on the entire surface according to planting pattern. Examples of perennial legumes being evaluated: *Neonotonia wightii* cv *Cooper*¹ and *Stylosanthes guianensis* cv *Guianensis*².

*Neonotonia wightii* in bananas - Photo IT2*Stylosanthes guianensis* in bananas - Photo IT2

1.2- Local cover crops in bananas

■ These plants occur locally and were selected for their speed of installation and their monospecific cover. The difficulty lies in their distribution (seed not available on the market), but the development of implantation techniques is in process. Examples:

- *Drymaria cordata* or West Indian chickweed¹



West indian chickweed in bananas - Photo IT2

■ The installation of West indian chickweed in bananas combined with herbicide application in “ultra low volume” can significantly reduce the amount of herbicides used per hectare.

- *Cleome rutidosperma* or Kaya blan , consumption weed



Consumption weed in bananas - Photo IT2

- *Impatiens walleriana*² or busy Lizzie (mountainous areas, especially in Guadeloupe).

■ Impatiens is an annual plant that is found in cool and shaded areas, at altitude. It bears brightly coloured or white flowers. When the pods are ripe they explode and scatter the seeds.

■ Several advantages make it an interesting cover crop in altitude bananas:

- quick covering of bare soils in favourable conditions (shade and coolness),
- does not compete with bananas for nutrients as its needs are limited,

- its roots do not constitute a good environment for *Radopholus similis* nematode's multiplication.



Busy Lizzie in bananas - Photo IT2

■ If you notice any of these local plants in your fields, don't destroy them. They'll end up establishing a spontaneous cover which will reduce the use of herbicides. The cover must be encouraged by destroying and preventing the installation of other undesired weeds.

2. MECHANICAL CONTROL

■ Another way of controlling weeds is through mechanical weeding.

	Mulcher	Brush cutter	Hand weeding
Advantages	Optimisation of work time	Cheap equipment	Very simple
Disadvantages	<p>Only in the large row of mechanized fields</p> <p>The width of the tractor system + tools must be adapted to the width of the large row</p> <p>Soil compaction (do not operate after rain or on clay)</p> <p>High cost</p>	<p>Noisy for the operator</p> <p>Tricky in young bananas</p>	<p>High workforce cost</p>

■ Plant residues (leaves, cuted pseudo-stems) can be put on the ground in order to reduce weed growth and erosion. The best is to spread them through all the soil surface, but the most convenient for mechanization and field circulation is to place them at every other row (or in the small rank when planted in double rows).

3. CHEMICAL CONTROL

■ Chemical control should be rational depending on the level, type of weed, crop stage (young plantation or established plantation).

GESTION DE L'ENHERBEMENT

3.1- Characterization of level and type of weed

- The level of weeds on a plot is characterised by:
 - the percentage of soil surface covered by weeds, from 0 (bare soil) to 100% (full coverage),
 - weeds' development stage.
- There are 2 categories of weeds:
 - *monocotyledons* (herbs and grasses), which leaves usually have parallel veins and roots are in a bundle. Examples : sorghum, water grass, zeb gwa, ray grass;
 - *dicotyledons* / broadleaf plants (very large number of species), with generally pivoting root system. Examples: bitter melon, wild spinach, seed-under-leaf.
- Weeds can be annual (1 year cycle) or perennial (cycle with 2 or more years).
- The more the plant mass is, the more difficult it will be to destroy. Destruction should be done while plants are young and poor developed, before seed production, working on spots if possible.

3.2- Product selection

- Herbicides are distinguished by:
 - **Their mode of action: contact or systemic**
- Systemic herbicide** (glyphosate type): the product penetrates the plant through its green parts; it is conveyed by the sap and destroys both aerial parts and roots of the plant. Application is done with a low volume of water (100 l/ha maximum); the mixture is concentrated. Systemic herbicides are generally used in established fields, and during the first cycle, 4 or 5 months after planting (when plants are very vigorous).
- Contact herbicides:** only the portion of the plant in contact with the product is destroyed. The root system is preserved. If the plant is annual, it will be destroyed but if it is perennial, regrowth is usually rapid if weather conditions are favourable. Application is done with a large volume of water (200 to 400 l/ha) in order to thoroughly wet the grass to destroy. It is recommended to apply a contact herbicide in young banana fields.

- Selectivity

Herbicides can be selective (graminicides) or non selective (efficient on all weeds).

3.3- Apparatus and nozzle type

- Devices called "low volume sprayers" and "ultra low volume sprayers" can be used for the application of pure or concentrated herbicide in the form of micro-droplets. They greatly reduce the amount of herbicide applied per hectare compared to the conventional equipment. As these devices generally operate by gravity, care should be taken when spraying, to always keep the lance pointing downwards.



ULV (ultra low volume) device - Photo IT2

- Other spraying devices can be used:
 - knapsack pressure maintained sprayer,
 - motorized knapsack with constant pressure: more comfortable for the user. These sprayers can optionally be equipped with booms (used for fallow),
 - devices with winding hose, carried on a tractor: they are hardly used.
- There are several types of nozzles
 - flat fan nozzles, can be with air injection for drift control;
 - flooding nozzles, sprays perpendicular to the surface;
 - swirl nozzles.

Different flows exist for each type of nozzle (different nozzle colours) - cf. next page table.





















4. EXAMPLES OF HERBICIDE APPLICATIONS

4.1- At planting

- This period is the most sensitive to weeds because of the abundance of light that promotes their growth.
- Planting bare fallow (spontaneous grass):
 - total weeding 3 to 4 weeks before planting with a systemic herbicide,
 - then use contact herbicide up to 5 months after planting.
- The application of herbicides has to be precise as young bananas are sensitive to the toxicity of these products.
- Planting on grassy fallow (cover crop): refer to data sheet "Brachiaria decumbens".

4.2- In established plantation

- Herbicide treatment aims to reduce weed pressure by the depletion of seed stock:
 - work in spots by applying the product only on weeds,
 - treat when vegetation is still low; for grasses, treat before heading stage.
- The use of herbicides must be in compliance with phytosanitary regulations.

TYPE OF NOZZLE	 ADI flat fan	 CVI flat fan	 AVI flat fan	 APM flooding	 ATR swirl	
SPRAY PATTERN	 110°	 110°	 110°	 50/ 100°	 80°	
GROUND PROJECTION						
SIZE OF DROPLETS	 Average 300 to 400 µm	 Big 400 to 600 µm	 Big to very big 500 to 600 µm	 Very big ≥ to 600 µm	 Very thin ≤ to 150 µm	
AVERAGE	Drift	Light	Very lighth	Light	High	
RECOMMENDED PRESSURES	2-4 bars	1.5-3 bars	3-5 bars	1-3 bars	3-20 bars	
HERBICIDE	CONTACT	Excellent	Good	Good	Excellent	Excellent
	SYSTÉMIC	Excellent	Excellent	Excellent	Good	Good

Source : G. Garampon, Phytocenter

IT2 is driving performance tests of natural post-emergent contact herbicides (vegetable oils and/or organic acid) to find alternatives to chemical control.

¹⁸² Technical and descriptive data sheets available from IT2.

[Links to Bananagap terms of reference V5: CB 7.1 to CB 7.6 IPM.](#)