

## **A Four-year timeframe to develop and begin extension of direct seeding mulch-based cropping systems, in the cotton belt of North Cameroon.**

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### **Summary**

Following falling cotton yields in North Cameroon (17 kg/ha/an) and the degradation of natural resources, the cotton development corporation (SODECOTON) has put in place many projects since 1994 with the assistance of French Agency for Development (AFD) and French Ministry of Foreign Affairs (MAE). The principal techniques used up till date consist essentially in slowing down soil run-off thanks to anti-erosion land management techniques or soil fertility improvement using manure or fertilising tree crops. SODECOTON supported by CIRAD is experimenting on direct seeding mulch-based cropping systems (DMC) since 2001 and trying to adapt the recommendations got from Côte d'Ivoire, Madagascar and Brazil. This experimentation is based on a four-point approach: 1) On-station trials carried out by IRAD in order to provide quantifiable scientific information on the impact of the system on tested crops. 2) Trials on controlled plots of 3 to 5 hectares in some villages. These locations have for objectives to enable a first selection under the various systems and also to serve as training grounds for farmers and extension agents; 3) Trial plots in farmers' fields (on-farm trial plots). These plots that measure between 100 and 2500 m<sup>2</sup> are farmer managed and are systematically compared to their traditional technique counterparts. A double objective is envisaged here: firstly to show the potentials of the DMC when put in to place by the farmer him/herself; secondly, to see the feasibility of the techniques proposed in order to adapt our technical recommendations. 4) Village community land test. Here the objective is to find out how DMC can be integrated in to the management of animal herds, land tenures and farm holdings. This experimental approach is completed by related activities: 1) trials on weed control using specialised herbicide applicators and/ or the application of specific herbicides. 2) Trial on and copying of planting materials and biomass management. 3) Trial on establishing different types of life hedges. 4) Training of partners (farmers and extension agents of SODECOTON). The first results from the controlled plots or on-farm are very encouraging, be they from the economic or agronomic standpoint of view (reviving soil life, improving water economy, increasing crop yields, reduction in farm labour). Activities at the village community level beginning 2005 should enable the workability of these systems at a much larger scale to be proven.

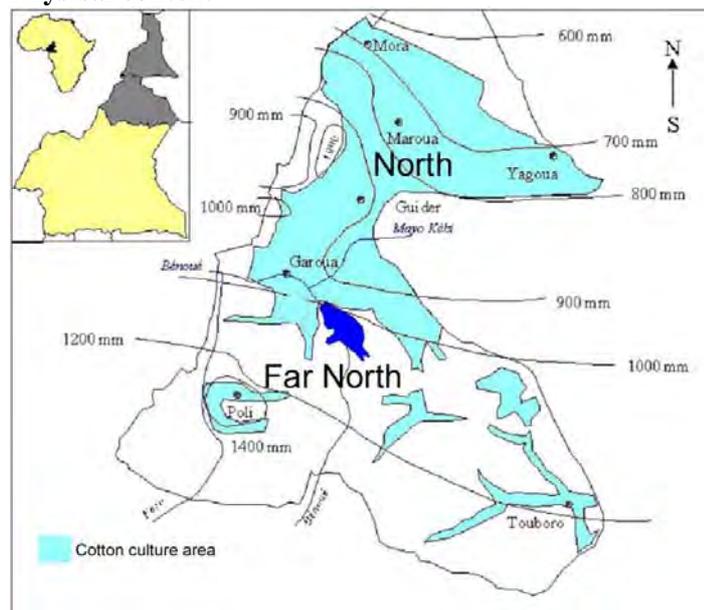
**Key words:** on-farm trial, cotton, sorghum, direct seeding mulch-based cropping systems.

### **Introduction**

Since 2001 Sodecoton (Société de développement du coton du Cameroun) with the assistance of CIRAD (Centre de coopération internationale en recherche agronomique pour le développement) has started DMC (direct seeding mulched based cropping systems) implementation actions adapted in North Cameroon. This present the process used since 2001 to carry out successfully this work.

We will first present the physical context (climate, soil) followed by institutional framework. We will see every scales of intervention of Sodecoton, we will continue with conclusions we can draw for these for years of field work, and finally we shall conclude by stating the future plans for the years to come.

## Physical context



**Map 1: North and Far-north Cameroon, in blue: cotton culture area**

The North and the Far-north provinces of Cameroon are very heterogeneous regarding rainfall (600 to 1400 mm) (Map 1, Figure 1), relief (vast plains and steep mountains) and population density and history (200 hab/km<sup>2</sup> in the mountains to 20 hab/km<sup>2</sup> in the North). In the semi-arid Far-North, main crops are millet, rainfed sorghum, transplanted sorghum, cotton, cowpea and rice. Major crop rotations are cotton-cereals or cotton-legumes-cereals. Fallow are scarce. Livestock raising is based on transhumance excepted in the more densely populated areas (mountains and east of the province). Average farm size is moderated: 2 to 3 ha.

## Institutional context

### *Cameroon a pilot country*

North Cameroon is part of 5 pilot countries (Laos, Madagascar, Tunisia, and Mali) where CIRAD tries to adapt and transfer DMC with the assistance of French aid: AFD<sup>1</sup>, FFEM<sup>2</sup>, MAE<sup>3</sup> (Séguy *et al.*, 2003). First trials started in 2000 and the project really began in 2001.

The implementation of DMC has been handed over to the fertility division of DPGT<sup>4</sup> project implemented by sodecoton. From 1994 to 2001 the fertility division of DPGT has established 70 000 ha with anti-erosion devices (weeded bands, stone lines,). It has also preserved 2 million of *Acacia albida* plants, 2 100 cowsheds for manure and 1 300 constructed reach. In 2002, the fertility division has been converted into a new project: ESA (Eau, Sol, Arbre) meaning (Water, Soil, Tree) with the objective to extend its activities on a large scale and continue to implement DMC.

### *Sodecoton the major rural development actor in the area*

- has 1700 agents to advise 350 000 farmers divided into 1 800 associations
- organises the production of over 200 000 ha of cotton
- deliver of inputs on credit to the entire territory
- decide the purchase price before the beginning of the campaign
- insure picking off cotton and commercialisation of fibre on international market

### *The partners*

Sodecoton relies on many partners to implement this work on DMC:

- CIRAD (Centre de coopération internationale en recherche agronomique pour le développement). It conducts five pilot projects mentioned above and others all over the world (Brazil, Vietnam, Cambodia, and Angola).
- IRAD (Institut de recherche agronomique pour le développement). IRAD carried out work on DMC based on annual contract with DPGT and ESA projects from 2001 to 2005.

<sup>1</sup> Agence française de développement

<sup>2</sup> Fond français pour l'environnement mondial

<sup>3</sup> Ministère des affaires étrangères

<sup>4</sup> Développement paysannal et gestion de terroir

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- OPCC (Organisation des producteurs de coton du Cameroun).this paramount organisation, bring together all the village cotton producing groups. It serves as link for communication actions trough organisation of visit to the farmers, articles in their journals,
- TERDEL (Teritoire et développement local) this organism is specialised in territory management. It has participated in working out the farming classification and the assistance to the farmers- livestock breeders' relationship.
- SADEL (Local Development Supporting Service).this office has an expertise in matters related to advising in farm management. It assists ESA project since 2004 in the integration of DMC technique recommendation to a global process of farm advising...

*Advantages and disadvantages of northern Cameroon for implementing DMC*

Advantages:

- Almost half of the crops, including cotton, are already cultivated by direct sowing,
- 80% of the farmers are cotton producers and are advised for fields' work by more than 500 sodecoton agents.
- The cotton producers' organisation (OPCC) federates the 1 800 producer association.
- Inputs (herbicides, weeds treatment, fertiliser,) are already used by almost all the farmers.

Constraint

- Free-roaming cattle
- Land tenure : no permanent land rights in some area of the North province
- Lack of support from administration

*Framework for techniques designing and begin extension of DMC:*

The objectives of the primary phase of the work (2001-2006) were to designing cropping systems adapted to north Cameroon, prove their economic value and start an extension with some farmers. With this aim, a several points' framework have been progressively set in place (table 1)

**Table 1 : evolution of mechanism set in place for the implementation of conservation agriculture system**

	2001	2002	2003	2004	2005*
IRAD researchers work	X	X	X	X	X
Farmers' fields trials (nb of fields)	35		110	300	
DMC controlled experimental fields	Complete (3-5 ha)	0	2	2	2
	Delocalised in the village (0,5 ha)	0	0	0	
Village community land test	0	0	1	10	8
DMC field blocks	0	0	0	0	5
Farming management advising (nb of farms)	0	0	0	0	8
Training of, farmers, partners and Sodecoton agents (nb of trained persons )		1 000	1 000	2 000	2 000
Multiplication of crops (nb of collections)	3	3	3	11	15
Introduction / adaptation of agricultural tools		X	X	X	X

\* Previsions

We shall see in the next chapters of what consist these activities, their interest, their limits, and the attainment.

**Tests at the station and IRAD researchers work**

*Implementation*

IRAD (Institute of Agricultural Research and Development) of Garoua

*Main activities*

Tests of different crop rotation on:

- The adaptation of the different cover crops to the north Cameroon conditions, their nitrogen fixation and biomass production
- Identification of the best precedent to cotton under DMC (effect on the cotton yield).(M'biandoum *et al* 2005)

Comparison of DMC to conventional system with regard yield of cotton, cereal, and legumes.

Choice of cover crop to be intercropped with cereals.

DMC and livestock relationship: the modalities of utilisation of cover crop in livestock feed.

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### *Interests*

Reliable data because obtained by statistical method

### *Limits*

- Cultivation methods sometimes far from farmers' ones
- Expensive

### *Major attainment*

Contribution to the selection of cover crop to be intercropped with cereals based on their residual effects on cotton, their nitrogen fixation and their biomass productivity

## **Farmer's experimental fields**

### *Implementation*

Farmer managed with only the technical assistance from sodecoton agents

### *Major activities*

Side by side, on the same field, comparison of the DMC and conventional plot. Comparison of :

- yield,
- economic margin,
- working time,
- impact on fibres quality,
- impact on the physical and chemical properties of soil,
- and weeds.

The implemented DMC cropping systems have been selected with farmer. He carries all field works. He doesn't receive a grant to conduct his experiments, but the project gives compensation if the yield is poor on the DMC plot due to bad supervisor's error.

### *Interests*

- Demonstration of interest in practising DMC under real condition by the farmers
- Feed-back information from farmers on practicability and interest of proposed system
- Test of the proposed system under multiple human and physical conditions
- Demonstration of DMC in almost 50 villages in the north and far-north of Cameroon

### *Limits*

- Expensive follow-up (villages are too scattered and access condition sometimes difficult)
- If the field is badly managed it can have an adverse effect on the perception of neighbours
- It is difficult to extrapolate from the obtained results , because several parameters vary from one field to another (soil, rainfall, sowing date, species, weed control)

### *Major attainment*

- Selection of systems interesting farmers and adaptation of technical recommendation
- Quantification of yield than can be expected when DMC is implemented by farmers (Naudin and Balarabe, 2005a, 2005b).
- Awareness of DMC by the farmers and extension agent of the entire cotton area



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**Picture 1 and picture 2: farmer's field, 2 years rotation in the Mambang village. 2003: sorghum, 2004: cotton. On left DMC field: sorghum + *Brachiaria ruzisiensis* in 2003 and cotton on mulch in 2004. On right: control field: sorghum on direct sowing on bare land in 2003, cotton after ploughing in 2004. Notice the effect of *Brachiaria ruzisiensis* on the striga and the advance of cotton farmed on DMC over the cotton after ploughing.**

### **Main controlled experimental fields**

Under 2 major sites (one in the North 5 ha, one in Far-North 3.5 ha):

#### *Implementation*

ESA project Sodecoton

#### *Major activities*

- Tests of different rotations including cereals, legumes and cotton with different level of fertilisation
- Tests of adaptation of cover plants to the environmental conditions.
- Training of farmers, livestock breeders, Sodecoton agents, and different partners.

#### *Interests*

On 2 major sites (one in the north, one in far-north):

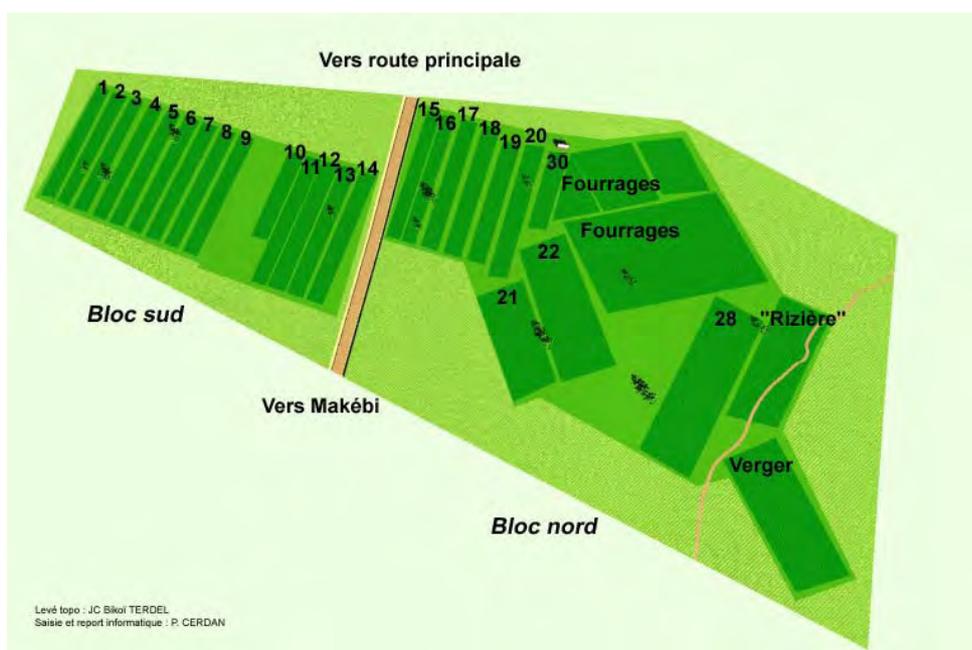
- Sites reserved to be re-conducted on DMC during more than 10 years (cumulative effect of DMC)
- Simplified experimental mechanism facilitating the treatment comparison by the farmers
- Support on the advanced thematic studies ( study of the fauna, soil, physical soil characteristics, crop water balance) (Soutou *et al* 2005, Naudin *et al* 2005, Brévault *et al* 2005)

#### *Limits*

- Simplified experimental mechanism not permitting advanced statistical analysis
- Relatively expensive (labour and inputs)

#### *Major attainment*

- Give an idea of DMC potential, and its impact on the yield, soil and macro-fauna, when it is conducted to optimum.
- Very meaningful demonstration for the farmers and the extension services.



**Figure 1: plan of the controlled experimental fields situated at Zouana in the far-north, total surface area of 3.5 ha. The numbered fields 1 to 28 receive rotations including cereals associated to cover plants, cotton and the edibles legumes. The land is slightly slanted. The lowest fields are occupied by rainfed rice and an orchard; the less fertile parts are occupied by a forage collection.**

### **“Under village” controlled experimental fields**

In 2004: 4 sites of 0.25 ha

*Implementation*

ESA project Sodecoton

*Major activities*

- Tests of different simplified rotations according to farmers' choices.

*Interests*

- Sites set up right in the middle of villagers' field more easily accessible than a research experimental station.
- Choice of rotations, cover plants and level of fertilization adapted to the local demand.
- Trial under varied ecological conditions
- Simplified experimental mechanism facilitating the treatment comparison by farmers

*Limits*

- Simplified experimental mechanism not permitting advanced statistical analysis
- Relatively expensive (labour and inputs)

*Major attainment*

- Give an idea of DMC potential and its impact on the yield when it is conducted to optimum.
- Very meaningful demonstration for the farmers and the extension services.

### **Village community land test**

*Implementation*

Farmers, livestock breeders and Sodecoton agents

*Major activities*

- Animations and negotiations implicating farmers, livestock breeders and authority in order to find and test new ways of handling land problem and livestock
- Demonstration of technical solutions. For example: increase in fodder production on a part of territory in order to decrease the pressure on crop residues on the “DMC part” of the territory.

*Interests*

- To study the solutions and constraint offered by DMC introduction in the management of land and livestock by the villagers
- To integrate DMC suggestions to the other ESA project activities (preservation of trees, anti-erosive constructions, negotiation of land).

*Limits*

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- It is Difficult to get coordinator capable to conduct resources management activities at the village scale.
- It is difficult to study the impact of DMC farming system at the village scale even though it's not spread neither totally fixed.

### *Major attainment*

- Starting the work with the livestock breeders to intensify fodder production
- Concentration of experimental fields in some villages.
- Beginning of reflection with the villagers on the integration of DMC to their land management system (Seugé *et al* 2005)

## **DMC fields Blocks**

### *Implementation*

Farmers with the assistance of Sodecoton agents

### *Major activities*

- Cultivation of 10 to 20 DMC fields side by side , begin in 2005 with 4 blocks
- Side by side comparison of DMC with and without crop residues to conventional techniques

### *Interests*

- To demonstrate the impact on the physical environment (reduction of erosion) of a concentration of DMC fields .
- Make it a partners training support

### *Limits*

Needs to find a sufficient number of farmers wishing to try DMC side by side

### *Major attainment*

Not yet

## **Supporting activities**

Several other activities were carried out to facilitate DMC creation and extension among the region.

- Training of sodecoton extension agents, farmers and other partners (NGO, livestock breeders): 4000 participants between 2002 and 2004.
- Introduction and adaptation of agricultural tools copy: jab planter, spray shield
- Multiplication of crops: hundreds of cereals, legumes and fodder plants have been tested and multiplied since 2001.

## **Lessons learned after 4 years**

After 4 years to establish and start extension of DMC in north Cameroon, we can draw a certain number of lessons:

- Not to hurry up and want to vulgarise very fast.
- Necessity of activities both on farm and controlled plots at the same times.
- Importance of farm fields for techniques and material adaptation.
- Working at the same time on the supporting activities "peripheral" to DMC: modalities for installation of live fences, fodder farming, manipulation of phytosanitary devices and pesticides.
- During the first years work (minimum of 2 years) to work at filed level before crossing to farm or village level. There is no need start thinking on integration of DMC in the community land management, if we don't have a minimum of proven technical references
- Diversify technical offer (different crops, different rotations, different covers crop)in order to solve problems that are often different according to farming and areas
- Look for already existing plants in an area and that can sometimes be as efficient as the exotic cover plants. Learn from nature and human behaviour for covercrop and DMC choice.

## **The remaining things to do, the stakes**

After this first step (2001-2004) there is still a lot of work to do for the extension of DMC at a large scale.

This will probably be done with the assistance of the Sodecoton agents. For the years to come, for the project that will take over from ESA project in 2006, the objectives are as follows:

- Train the extension field workers effectively. This means that they should very well integrate the "philosophy» of DMC. They should not apply ready made formula , they should be able to utilise the solutions brought by DMC for any type of crop or problem to solve
- Design an individual farming advising method that permits to adapt technical recommendations very well according to objectives, constraint and means of every farmer.

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- Continue to look for wild plants in the area that can integrate DMC rotation.

### Conclusion

We have seen that north Cameroon has constraint and advantages for DMC practice. Its major advantage includes the presence of Sodecoton, its supervising network and the delivery of many inputs on credit for all villages. The second is the abandon of ploughing already started by many farmers. Now half of the crops are farmed by direct sowing and this practice is increasing. This phenomenon is due mainly to the availability of total herbicides such as paraquat or glyphosate at subsidised cost. The major constraint of north Cameroon is the management systems of land and livestock which are not that favourable to the intensification of agriculture.

The mechanism set in place in north Cameroon for this phase of implementation of DMC, tries to be the most complete as possible. Therefore right from the beginning, experiments were carried out on stations and in farmer's areas. On other hand, the project was carried out at a scale of field, farm and village. Finally the "peripheral" actions to DMC have been carried out: vulgarisation of fodder, installation of living fence, the simultaneous running of these different approaches seems to be the necessary condition i.e. if we want to succeed the vulgarisation of DMC in short term.

From 2002 to 2004 almost 4000 persons (farming supervision, farmers, livestock breeders) have benefited of: visit to experimental fields, training and information meetings on DMC. At the same time the first experimenting farmers were able to present their experience over radio programs and ESA project distributed many information articles. We can say that from today DMC start to be well known in the rural area. It remains now to impart to the 400 sodecoton field agents and to the farmers, the acquired knowledge on cover crop, rotations and tools by the project. We can really consider that the bet is won, when the farmers will create DMC they own DMC systems. It remains that, the constraint on land and livestock that exist in some areas of north Cameroon cannot be solved by a project. Our role is to show on the field, the interest of better management of land and biomass. The administrative and the traditional authorities should show the will to improve the locally blocked situations. But this largely beyond the DMC context. In our opinions, Cameroonians cannot avoid this evolution if they wish to modernise their agriculture and their society in general.

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