Prototyping integrated cotton crop management systems for specific ecological and socioeconomic constraints in Western Africa

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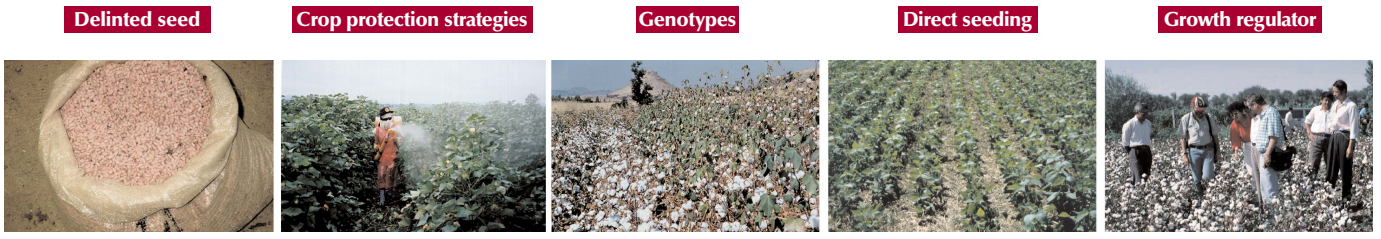
In the savannas of West Africa, cotton production has grown by 400% during the last two decades. This steep rise occurred simultaneously with ecological, socioeconomic and institutional changes. Meanwhile, recommendations to farmers remained relatively steady and, as a result, cotton productivity stopped improving during the last decade.
Today, the crop sustainability is jeopardized and the farmers are looking for new crop management systems (CMS) better adapted to their constraints. To provide these, we have developed a methodology based on the prototyping approach (Vereijken, 1997). This methodology aims at designing and testing CMS adapted to selected combinations of biophysical and socio-economic constraints. It takes advantage of experts knowledge on cropping techniques (no-till, cover crop, growth regulator…), not yet included in crop models but having innovative potential (photos).

Methodology

• The methodology involved successive phases during which selected actors (scientists, rural developers, farmers) could (i) identify and classify the major constraints on cotton production in the sub-Saharian region, (ii) select one set of constraints with high priority in Cameroon and Mali, (iii) design a CMS prototype and its evaluation criteria, (iv) test and adjust the prototypes for a new round of experimentation. The prototype was adjusted after comparing target values determined by the scientists for the evaluation criteria or management indicators (*eg* crop stand, plant height, canopy development, earliness, shedding) and the actual values obtained in the field.
The CMS prototype was evaluated with indicators showing its agronomic and economic performance, as well as its "practicability", sustainability and environmental safety.
• The methodology was implemented and tested in 2002 at six locations of Cameroon and Mali. The set of constraints included late-planting in a water-limited environment, small-scale farming with easy access to fertilizers and pesticides. The CMS prototype (Figure 1) was designed by the scientists during a regional and international workshop and adjusted in each country with local experts (including farmers).



Photos. Examples of cropping techniques studied by disciplinary scientists, which may be assembled for specific objectives.

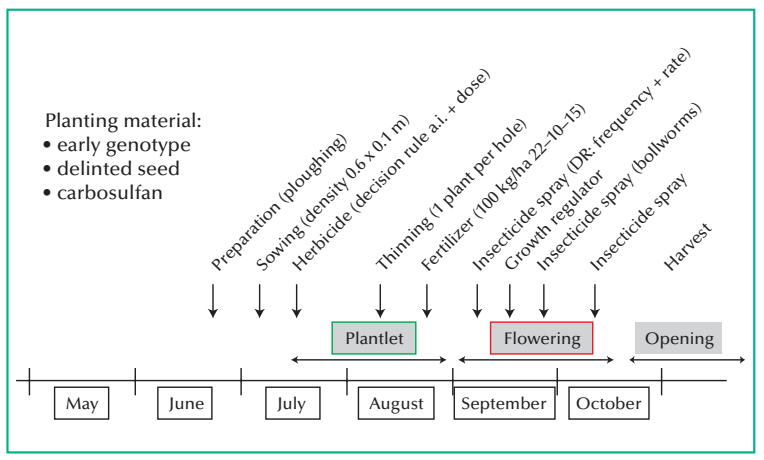


Figure 1. CMS prototype for late planting.

Results

Compared to the CMS based on standard recommended practices (C), the CMS prototype (P) showed an average 35% yield increase (Table 1). It also produced more income to the farmer but at the expense of extra labor and increased use of pesticides. The average ginning out-turn of the prototype was satisfactory although the locally bred variety Nta 93-15 that was included in the Mali's prototype performed slightly better than exotic Guazuncho in the Cameroon's one.

Table 1. Example of CMS indicators (P or prototype's results are given as a difference with the check C).

Location	Yield * (t/ha)		GOT ** (%)		Income *** (€/ha)		Labor **** (md/ha)		Applic. Nb *****	
	C	P-C	C	P-C	C	P-C	C	P-C	C	P-C
Kodek (Cameroun)	0.45	+0.41	42.7	-0.8	45	+62	59	+6	6	+7
Guiring (Cameroun)	0.11	+0.10	39.0	+1.1	-47	-23	48	+1	6	+7
Makébi (Cameroun)	0.47	+0.23	40.7	-1.6	64	+29	59	+11	5	+ 5
Sanguéré (Cameroun)	0.73	+0.42	41.3	-0.2	95	+55	77	+15	7	+8
Sotuba (Mali)	1.75	+0.23	41.7	+1.8	412	+37	78	+14	5	+3
Farako (Mali)	0.81	+0.13	44.3	+0.7	152	+18	74	+4	5	+3
Mean	0.72	+0.25	41.6	+0.2	120	+29	66	+8	5.7	+5.5

*: Seed cotton yield; **: Ginning out-turn or fibre percentage; ***: Income after deducting the inputs; ****: Total labour required in men-days per ha. *****: Total number of chemical applications (herbicide + insecticide + growth regulator)

Discussion

The results obtained during this first experimental phase highlighted the agronomic potential of the prototypes but also the need to improve their socio-economic and environmental sustainability. Consequently, the experts decided to adjust the dates of planting, to favor locally adapted genetic material, to limit the number of chemical applications and to explicit specific rules for managing growth regulation. This experimentation was repeated in 2003 with the adjusted prototypes.

REFERENCE

Vereijken P., 1997. A methodological way of prototyping integrated and ecological arable farming systems (I/EAFS) in interaction with pilot farms. Eur. J. Agron., 7, 235-250.

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