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ABBREVIATIONS

ABB	available biomass for burning
ABT	Alimentation du Bétail Tropical (Program for the "Improvement of Feeding Systems of Tropical Livestock", ISRA/CIRAD-EMVT)
Adu	adult
AGB	above-ground biomass
BGB	below-ground biomass
CEC	cationic exchange capacity
CI	cropping intensity
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement (French International Centre for Agricultural Research in Hot Regions)
CNRS	Centre National de la Recherche Scientifique (French National Centre for Scientific Research)
Com	compound
Cor	corralled
DM	dry matter
DMI	dry matter intake
EMVT	Département Elevage et Médecine Vétérinaire (Department of Animal Production and Veterinary Medicine)
ENGREF	Ecole Nationale du Génie Rural des Eaux et des Forêts (French Institute of Forestry, Agricultural and Environmental Engineering)
Equ	equipment
FA	fallow
FOME	faecal organic matter excretion
FU	feed unit
GHG	green house gas
GLM	general linear model
GN	groundnut
INRA	Institut National de la Recherche Agronomique (French Institute for Agronomic Research)
IRD	Institut de Recherche pour le Développement (French Institute for Research and Development, formerly ORSTOM)
ISRA	Institut Sénégalais de la Recherche Agricole (Senegalese Institute for Agricultural Research)
LS	least square
LUS	land use system
LW	live weight
MA	maize
MI	millet
MW	metabolic weight
NF	non-fractionated
OF	old fallow
OM	organic matter
OMI	organic matter intake
OS	owned surface
PC	principal component
PCA	principal component analysis
PET	potential evapotranspiration
Pm	permanent
P_{OD}	available phosphorus (Olsen method modified by Dabin, 1967)

P_t	total phosphorus
RI	rice
RI	rice
R_S	correlation coefficient of Spearman
SAS	statistical Analyses System
Sea	seasonal
SOC	soil organic content
SODEFITEX	Société des Fibres Textiles
SOM	soil organic matter
SSA	sub-Saharan Africa
TLU	tropical livestock unit
UWS	upper woody strata
Wa	household waste
WAS	West African savanna
WU	working unit
YF	young fallow

TABLE OF TABLES

Table 1.1 Regression coefficients used for woody biomass estimate for the four main species found in Sare Yorobana. 20

Table 1.2 Carbon, nitrogen and phosphorus content of: a. Plant components of the four main woody species. Contents for other species were estimated as the mean of these values. b. Other above- and below-ground plant components of cropped and fallow fields. 23

Table 1.3 Dry matter storage in plant components under a crop-fallow succession. 24

Table 1.4 Estimates for parameters of a regression of S = {amount of dry matter, carbon, nitrogen or phosphorus} on t= length of fallow, according to a logistic-like model. 25

Table 1.5 Simplified budget and annual increase of dry matter, carbon, nitrogen and phosphorus in above- and below-ground plant biomass during a crop-fallow succession. 27

Table 1.6 Anova performed on dry matter, carbon, nitrogen and phosphorus amounts in plant biomass of cropped and fallow plots 28

Table 2.1 Soil C, N, and P_{OD} content, C:N ratio and modified [0-2000] μm bulk density in groundnut and fallow plots. 43

Table 2.2 Effect of land management (fallowing) and texture (clay+fine silt content) on soil properties. 47

Table 2.3 SOM fractionation in groundnut and fallow plots. 49

Table 2.4 Effect of land management (fallowing) and texture (clay+fine silt content) on SOM quality 50

Table 2.5 Effect of land management (fallowing) and texture (clay+fine silt content) on soil C (total and in fractions), N and P_{OD} storage. 52

Table 3.1 Biomass of groundnut, millet, maize and rice: a. dry matter storage. b. C, N and P_t content. 71

Table 3.2 Soil C, N, P_{OD} content, C:N ratio and modified [0-2000] μm bulk density of groundnut, millet, maize and rice fields. 74

Table 3.3 Effect of cultivation intensity and texture (clay+fine silt content) on soil properties. 77

Table 3.4 SOM quality as assessed by SOM fractionation in the soil sublayers of millet, maize and rice fields. 79

Table 3.5 Effect of cultivation intensity and texture (clay+fine silt content) on SOM quality as assessed by C concentration and content, and C:N ratio in non-fractionated soil and in fine- and coarse-size fractions. 80

Table 3.6 Effect of cultivation intensity and texture (clay+fine silt content) on soil C, N and P_{OD} storage (computed in equivalent soil masses). 81

Table 3.7 Effect of management of organic inputs on soil physical properties and organic status. 82

Table 4.1 Settings of C, N and P_{OD} stored in soil (0-20 cm layer) for the calculation of budgets at the village scale, as related to land use (in the case of fallow and rice), ring of management, vicinity of a compound, and cropping intensity. 105

Table 4.2 Surface distribution (ha) of land use with respect to ring of management and geomorphology in the village of Sare Yorobana. 107

Table 4.3 Elementary statistics characterising 16 holdings of the village of Sare Yorobana. 110

Table 4.4 Regression relations of yields between plant biomass components. Model: $Yield_{Component} = a*Yield_{Harvest} + b$. 112

Table 4.5 Mean DM, C, N and P storage in a few agro-ecosystems of Sare Yorobana with respect to ring management and land use. 113

Table 5.1 Plant biomass partitioning of crop harvest measured for cereals in Sare Yorobana. 136

Table 5.2 Dry matter, carbon, nitrogen and phosphorus budgets of the land use systems exploited by peasants of Sare Yorobana in and around the village territory, as related to crop harvest, livestock-mediated transfers, wood and straw harvest, and residue recycling. 137

Table 5.3 Dry matter, carbon, nitrogen and phosphorus intake and excretion by livestock measured during the 1997-1998 dry season. 141

Table 5.4 Behaviour of the cattle of three holdings during day straying as influenced by land tenure, herd size and surface owned by the holding (dry season 1995-1996). 141

Table 5.5 Input of dry matter to fields from manuring during night corralling as influenced by the plant species planned for cropping. 143

Table 5.6 Participation of crop harvest, livestock, and collecting of wood and straw to anthropogenic carbon, nitrogen and phosphorus transfers due to farming activities. 145

Table 6.1 Heat combustion data of grain and vegetative biomass. 157

TABLE OF FIGURES

Figure 0.1 Location of the study site of Sare Yorobana in Senegal, West Africa, and isohyets for the 1951-1980 period. 8

Figure 1.1 Simplified ring organisation of a village of the mixed-farming system of the West African savanna belt... 15

Figure 1.2 Monthly patterns of rainfall, potential evapotranspiration and temperature at the station of Kolda, 1978-1997. 18

Figure 1.3 Distribution of the length of fallow among the 28 sampled plots of fallow. 19

Figure 1.4 Dry matter, carbon, nitrogen and phosphorus storage in plant biomass during a crop-fallow succession, and fitting to a modified, logistic-like model. 26

Figure 1.5 Fate of dry matter, carbon, nitrogen and phosphorus in above-ground woody biomass after clearing of a young and old fallow. 30

Figure 2.1 Principal components analysis of the soil properties of a chronosequence made of six cropped plots and 11 fallow plots. 46

Figure 2.2 Evolution of soil C, N and P_{OD} storage in the 0-10 and 0-40 cm layers along the crop-fallow succession. 51

Figure 2.3 C, N and P storage in the plant-soil system at three main stages of the crop-fallow succession. 53

Figure 2.4 Root decomposition dynamics of Combretum glutinosum Perr. after clearing of a 15 years old fallow as measured during a mesh-bag experiment. 54

Figure 2.5 Estimated remaining amounts of dry matter, carbon, nitrogen and phosphorus from the decaying root component after clearing of a young and old fallow (stumps removed). 55

Figure 3.1 Plant and soil carbon, nitrogen and phosphorus storage in main cash and food crops along a typical toposequence in Sare Yorobana, southern Senegal. 73

Figure 3.2 Principal components analysis of the soil properties of 12 cropped plots. Correlation circles of the variables and projection of the plot replicates on plane PC 1x PC2. 76

Figure 3.3 Carbon, nitrogen and phosphorus organic inputs in compound fields under three different patterns of organic management of fertility. 83

Figure 3.4 Assessment of soil quality of 23 crop and fallow plots as predicted by Feller's criterion (1995b) based on carbon content and fine texture. 89

Figure 4.1 Mean annual rainfall over the last 60 years. 101

Figure 4.2 Spatial organisation and land use in the village of Sare Yorobana. 108

Figure 4.3 Spatial distribution of land use as illustrated by the distance of crops to the compound. 109

Figure 4.4 Spatial complementarity between cropping intensity and manuring in the mixed-farming system of the village of Sare Yorobana 109

Figure 4.5 Principal component analysis of the structure of 16 out of the 18 holdings of Sare Yorobana: correlation circle of the variables and compound replicate projection (1st and 2nd PC)..... 111

Figure 4.6a Carbon storage in plant biomass and soil of the territory of the village of Sare Yorobana with respect to geomorphology, ring and land use (cropped, non-cropped). 114

Figure 4.7 Self sufficiency in manure and forage availability in the holdings of Sare Yorobana as derived from a simplified agro-pastoral budget. 117

Figure 4.8 Analysis of sensitiveness of carbon storage calculation as related to the threshold value of cropping intensity driving woody advent biomass in cropped plots: impact of a variation of less or more then 10 % of this threshold value on C stock estimates. 117

Figure 4.9 Evolution of land use in the village of Sare Yorobana for the 1997-2047 period as predicted by a static model. 118

Figure 4.10 Evolution of carbon storage in the plant-soil system (soil: layer 0-20 cm considered only) of the territory of the village of Sare Yorobana for the 1997-2047 period as predicted by modelling..... 119

Figure 5.1 Anthropogenic flows of carbon established from November 1996 to November 1997 in Sare Yorobana. 138

Figure 5.2 Anthropogenic flows of nitrogen established from November 1996 to November 1997 in Sare Yorobana. 139

Figure 5.3 Anthropogenic flows of phosphorus established from November 1996 to November 1997 in Sare Yorobana..... 140

Figure 5.4 Organic matter inflows and outflows initiated by intake and faecal excretion of three herds during the 1995-1996 dry season..... 142

Figure 5.5 Manuring intensity from night corralling in the village of Sare Yorobana during the 1996-1997 dry season. 143

Figure 5.6 Millet yield as related to manuring practices in the compound and bush rings. 144

Figure 5.7 Evolution of anthropogenic carbon outflows ratio of C outflow to amount of C stored in plant above-ground biomass of the territory of the village of Sare Yorobana for the 1997-2047 period as predicted by modelling..... 146

Figure 6.1 Human and livestock densities in Sare Yorobana as compared to other situations in Senegal and northern Ivory Coast. 156

Organic matter dynamics in mixed-farming systems of the West African savanna: a village case study from south Senegal

Raphaël Manlay

Organic matter (OM) is a multi-purpose tool in West African smallholder mixed-farming systems, but its supply has been decreasing for several decades. To assess the viability of a mixed-farming system of south Senegal, carbon (C), nitrogen (N) and phosphorus (P; available in soil and noted P_{OD}) budgets (stocks and flows) were thus quantified.

The village territory of the study showed a ring-like organisation with growing intensification of fertilization and cropping practices from the periphery (bush ring) to the compounds (compound fields).

Stocks in plant and soil averaged 55 tC, 26 tN and 43 kgP ha^{-1} in old fallows. They were 100, 30 and 250 % higher than in the bush cropped fields, plant biomass accounting for nearly all of the rise. C, N and P amounts recorded in the soil of compound fields were higher than those of the bush field, but the increase was restricted mainly to the 0-10 cm layer. However, the rather weak response of local sandy soils to management can be interpreted only by reassessing the bio-thermodynamical signification of soil organic carbon cycling in the maintenance of the integrity of local agroecosystems.

Manageable stocks of the whole village territory were estimated to 30 tC, 1.5 tN and 26 kgP ha^{-1} in 1997. Carbon was stored mainly in soil. Livestock, crop harvest and wood collecting were responsible for respectively 59, 27 and 14 % of the C uptake on the village territory. As a result, large C flows were set towards the compound ring (3.8 tC ha^{-1} y^{-1}). N and P depletion of the system amounted to 4 kgN and 1 kgP ha^{-1} y^{-1}, suggesting that the system was close to nutrient balance.

Under current demographic growth rate, C depletion may reach 0.38 tC ha^{-1} y^{-1} and C demand may double during the next three decades. Without any intensification of farming practices, the viability of the system might soon be called into question.

Doctoral Thesis

ENVIRONMENT