Carbon in Vietnamese Soils and Experiences to Improve Carbon Stock in Soil

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Abstract: According to FAO-UNESCO classification, Vietnamese soils are classified in 14 main great soils groups with 31 units. Among of 33,115,000 ha of total Vietnamese soils in main land, only less than 10 million of ha are used for agriculture. This paper reported the results of organic carbon study in term of total concentration of more than 1200 soils samples collected in 6 main great groups of Vietnamese soils: Fluvisols; Acrisols (degraded soils); Ferralsols; Arenosols (sandy soils); Acid sulfate soils; Saline soils. These are main soils located for agricultures activities. Carbon stock in soils was interpreted as organic carbon content analyzed in upper layer with the Walkley-Black methods. The results showed that, Acid sulfate soils had highest organic carbon content with the mean of 3.80 %; ferrasols had an organic carbon content of 2.22 (%) in the second place followed by fluvisols (1.99 %) and saline soils (1.72%) and acrisol (1.08 %). the organic carbon content in sandy soil (arenosol) was the lowest (0.68%). Organic carbon and therefore carbon stocks in soils were much closed correlated with soil texture and agricultural practices. General tendencies of carbon stock in Vietnamese soils are slowly decreasing in annual cropping systems, especially in cash crop and vegetable farming. Farm yard manure and crops residues returning to soils may significantly contribute to improvement of soil organic level in soils. Improving carbon stock in some great soil groups was discussed to guide cropping and inform the acceptable carbon level in soil.
Keywords: organic carbon; Vietnam soils; carbon stock

1. Introduction

Vietnam counts today more than 85.7 millions of people and Vietnam's inland surface is 33,115,000 ha. Most of Vietnamese lands are under forestry (44.7%), only 28.4 % are used for agriculture with the total surface of 9,420,300 ha (Table 1). Faced with high population pressure (85,6 millions people), food security has becoming overriding political and economic goal in the past twenty years and in the day coming with the challenge of the climate changes.

Table 1. Land use in Vietnam

Areas as classified by land used (2008)	Area (ha)	%
Agriculture land	9,420,300	28.4
Forestry land	14,816,600	44.7
Non-Agricultural land	3,385,800	10.2
Aquaculture land	728,600	2.2
others lands	3,666,300	11.1
Water surface	1,097,400	3.3
Total of Vietnam Areas	33,115,000	100

From Vietsat (2008)

Rice, maize, cassava, peanut, soybean, sweet potato are the main food crops while rice remains the dominated crop in area and in production of Vietnam with the total annual planted areas more than 8,3 million ha and a production of 35,9 millions tons (data 2007, Table 2). It is noted that only less than 4,000,000 ha of land are allocated for rice planting, but farmers have two or even three rice seasons annually.

Table 2. Main crops production in Vietnam

		1000 ha	1000 tons	
N.	Crops	Planted area	Production	Crop classification
1	Rice	8,304,700	35,942,700	Food
2	Maize	1,096,100	4,303,200	Food
3	Cassava	495,500	9,395,800	Food &cash
4	Peanut	254,500	510,000	Food & cash
5	Soybean	187,400	275,200	Food & cash
6	Sweet potato	175,500	1,437,600	cash
1	Rubber	556,300	605,800	Industrial
2	Coffee	509,300	915,800.00	Industrial
3	Cashew nut	439,900	312,400	Industrial
4	Sugar Cane	293,400	17,396,700	Industrial
5	Coconut	135,300	1,034,900	Industrial
6	Tea	126,200	705,900	Industrial
7	Pepper	48,400	89,300	Industrial

From Vietsat(2008)

A recent overview of rice production in Vietnam (Pham Quang Ha, 2010) reported that, over last 50 years (1960-2010), rice production in Vietnam was increased both yield (2.51 times), area (1.53 times) and therefore rice production was increased up 3.84 times. Vietnam produced 35,942,700 ton of rice in 2007 and 38,725,100 million ton in 2008. This provided enough food more than 85.6 million Vietnamese and contributed to world food security. Vietnam is now the second world rice exporter with a total about 4-5 million tons of rice annually.

Rubber, coffee, cashew nut as well as tea and pepper are also promising cash crops for Vietnam. The areas planted for rubber and coffee were 536,300 and 509,300 ha, respectively, in 2007.

As rice production areas in Vietnam are located mainly in Mekong River (51%) and Red river delta (15%), these zones are considered most affected by climate changes where high sea level rises expected in different scenarios. With the worse cases, in 2100, more than 1.1 million ha of rice land in Mekong delta will be deeply submerged and some thousands hundreds of rice land in Red river delta will be salted. In addition with irregular storm, rain fall distribution, drought, plant deceases; it is a big challenge for Vietnam to keep a stable rice production in the end of this century. Different measures and actions were considered and taken by Vietnamese government and the Ministry of Agriculture and Rural development. Both adaptation and mitigation options were mentioned. It is hopefully that Vietnam can take over the new challenges in the coming decades to reach successfully the target of 3.8 million ha of soils for rice with a production annually of 43 million ton of rice as formulated by the year 2020.

2. The Distribution of Major Soil Groups and Soil characteristics

According to FAO-UNESCO classification, Vietnamese soils are classified in 14 main great soils groups with 31 units. Main great soil groups used for agricultural activities are shown in the table 3; and its distribution along the country is showed in the table 4. Selective characteristics of these soils are showed in the table 5. It is noted that, these soils are mainly acidic as found in most tropical soils.

Table 3. Soils in Vietnam selon FAO-UNESCO or local classification

No	Main soil types/ local name	FAO-UNESCO	Area (ha)	%
1	Sandy soil	Arenosols	533,434	1.6
2	Saline soil	Salic fluvisols	971,356	2.9
3	Acid sulfate soil	Thionic Fluvisols	1,863,128	5.6
4	Alluvial soil	Fluvisols	3,400,058	10.3
5	Red Soil	Ferralsols	3,010,594	9.1
6	Grey Degraded soil	Haplic Acrisol	1,791,021	5.4
7	Ferralitic Soils	Other Acrisol	18,179,621	54.9
8	Other lands/areas	Other	3,365,788	10.2
Total of Vietnam Areas			33,115,000	100

Vietnam soil (1996)

Table. 4. Soil in Vietnam, distribution and dominant crops.

No	Main soil types	Main distribution areas	Dominant crops types	Annual harvesting seasons
1	Sandy soil	Coast central	Rice, peanut & cash crops	> 2
2	Saline soil	Coastal north and south	Rice, cassava & cash crops	1-2
3	Acid sulfate soil	Red & Mekong Rivers Deltas	Rice, cassava & cash crops	1-2
4	Alluvial soil	Mekong (MKRF) and Red Rivers (RRF) and others (ORF)	Rice, maize & cash crops	>2
5	Red Soil	Central high plateau; North hills & mountains	Maize, coffee, rubber & other industrial crops	1-2
6	Grey Degraded soil	Midlands of north & southeast	Rice, maize, & cash crops	>2
7	Ferralitic Soils	Hills & mountainous areas	Forestry & cash crops	1-2

Table 5. Selected characteristics of main soil types/groups for agricultural purposes

No	Main soil types	pH_{KCl}	N%	Clay (%)	Bulk density (g/cm^3)
1	Sandy soil	4.76-5.74	0.05-0.06	2.9-6.2	1.20-1.67
2	Saline soil	5.05-5.35	0.15-0.16	38-58	0.92-1.38
3	Acid sulfate soil	3.54-3.79	0.22-0.25	42-57	0.79-0.99
4	Alluvial soil	4.51-4.67	0.17-0.19	33-41	0.82-0.97
5	Red Soil	3.99-4.10	0.17-0.18	49-55	1.02-1.09
6	Grey Degraded soil	4.26-4.41	0.09-0.11	11-18	1.32-1.35

3. Carbon stock in soils as affected by soils types and soil characteristics

The term soil organic carbon (OC) has been used to measure indirectly the soil organic matter. Soils organic matters are not the same as biomasses in soils. As we define soils with three components: solids; gas and liquid. It is not easy to distingue soil organic carbon and soil biomasses.

The results of organic carbon study in term of total concentration of more than 1271 soils samples collected in 6 main great groups of Vietnamese soils (Table 6) used for agricultures activities: Fluvisols; Acrisols (degraded soils); Ferralsols; Arenosols (sandy soils); Acid sulfate soils; Saline soils. Carbon stock in soils were interpreted as organic carbon content analysed in upper layer with the Walkley-Black methods. The results showed that, Acide sulfate soils had highest organic carbon content with the mean of 3.80 %; ferrasols had a organic carbon content of 2.22 (%) in the second place followed by fluvisols (1.99 %) and saline soils (1.72%) and acrisol (1.08 %). the organic carbon content in sandy soil (arenosol) was the lowest (0.68%). Vietnamese fluvisols are found in rivers bassin, such as Red rivers, Mekong rivers and other rivers so called Red river Fluvisols (RRF); Mekong river Fluvisols (MKRF) and other river fluvisols (ORF) as three main type of fluvisols. Organic carbon content are respectively 1,57%; 2,03% and 2,81% in RRF, ORF, MKRF.

Both acid sulfate soils and saline soils are bearing alluvial and marine features, but acid sulfate soils are often newly explored and long year ago organic deposit in sea side explaining the highest carbon content in acid sulfate soils. The lowest clay content in sandy soils explains why in this soil, organic carbon is the lowest. Among other soil characteristics, computed for all fluvisols together, only soil nitrogen content was very high significantly correlated with organic content in soils. Table 7 showed linear regression coefficients between selected soils characteristics and organic contents in fluvisols.

Table 6. Organic carbon in main groups of agriculture soils (OC%)

STT	Parameters	Alluvial soil	Red soil	Grey degraded soil	Sandy soils	Saline soil	Acid sulfate soils
1	N. of samples (n)	211	233	229	212	230	156
2	Mean, OC %	1.99	2.22	1.08	0.68	1.72	3.8
3	Min, OC %	0.31	0.60	0.078	0.116	0.293	0.515
4	Max, OC %	4.04	4.14	3.22	1.698	3.694	7.294
5	Standard deviation	0.80	0.7	0.62	0.368	0.638	1.56

Table 7. Linear regression considering organic content is soils as dependent variable.

Predictor variable	Coefficient	Standard error	P (accepted)
Constant	1.18	0.40	0.004
CEC	0.01	0.01	0.381
K	-0.12	0.09	0.216
N	10.4	0.76	0.000
P	0.55	1.31	0.675
pH_{H2O}	-0.004	0.167	0.997
pH_{KCl}	-0.207	-1.28	0.201

Linear regression was made for the great group of alluvisol (fluvisols) in the Table 7, only nitrogen content was very high signficantlly correlated with organic carbon content in soils. In fluvisol, OC in soils is also expected as a fuction of alluvial deposit and land uses. Figure 1 showed nomal distrubution of organic carbon in fluvisols.

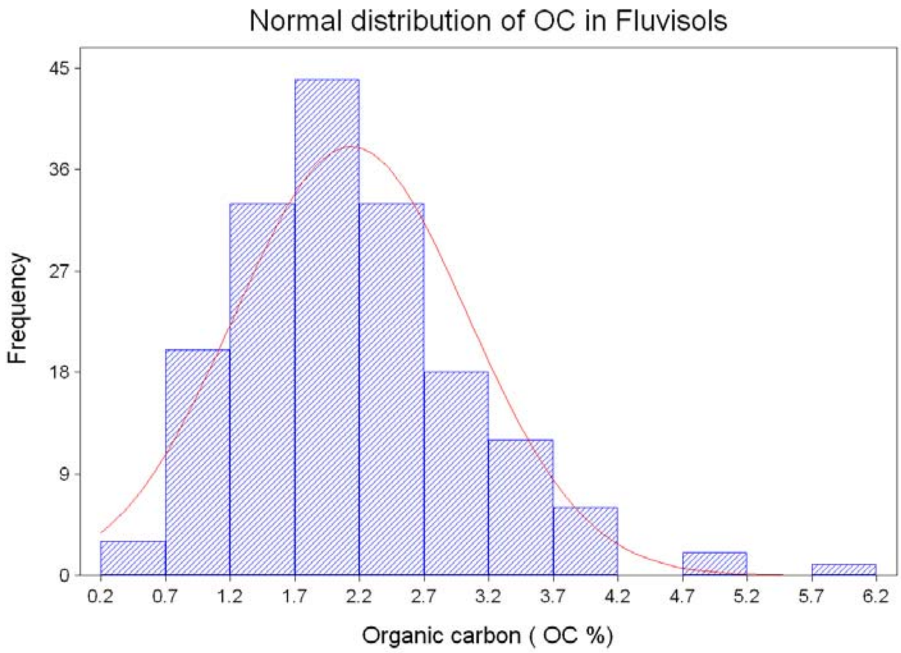

Fig. 1 Distribution of organic carbon in Vietnam fluvisol.

4. Carbon stock in soils as affected by cropping systems

Carbon stocks in soils were higtly affected by cropping systems. Among 172 samples computed for fluvisols, there are 7 combinations of cropping sytems entilled in the Table 8 and Figure 2. Results showed that, on the rice (R) based cropping sytems organic carbon contents were the greatest. Lower carbon contents were found in cash (C) based croppping sytems.

Table 8. Organic carbon in soils selon different cropping systems in fluvisol

Plant growth	Cropping systems	OC%	STD
Mulbery (cash crop)	C	0.93	-
Non rice annual crops such as vegetable, maize, leguminous (Cash crops)	C-C	0.76	0.01
Three cash crops	C-C-C	1.28	0.47
1 Rice-1 cash crops	R-C	1.49	0.05
Two rice crops	R-R	2.09	0.77
Two rices + 1 cash crops	R-R-C	1.40	0.56
Three rice crops	R-R-R	2.13	0.77

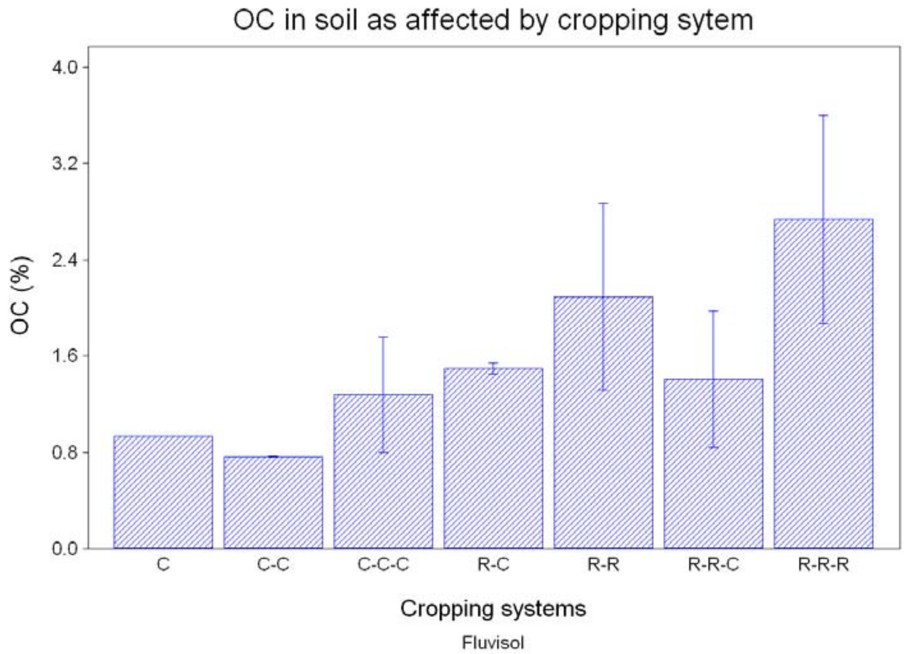

Fig 2. Organic carbon in Fluvisol as affected by cropping systems

It is critical to understand the difference in decomposition patterns of organic input and the role of organic matter in different cropping systems. The process is totally different between upland soil and under water soils. For example, in rice only cropping systems (2 or three rice cropping yearly) with short aerobic fallow periods, anaerobic decomposition leads to the development of more stable organic component, for that more organic carbon in soil remain stable and well conserved. In the other hand, soil for rice only is often under low land, submerged; the clay content are found higher in the upland soils. In heavy clay content soils, total soil organic content is increasing with time and reaching a new equilibrium

5. Improvement soil productivity an integrate solution to carbon stock in sandy soils

More then 36% of agricultural soils are classified as light textured degraded soils (such as arenosol and acrisol) that have a low inherent nutrient supplying capacity, low organic matter content and limited water holding capacity. Among these soils, about half of million hectares are sandy soil mainly located in coastal areas. Sandy soil occupied only 1.61 % of the territory and 4.61 % of agricultural soil but where leaving more than 10 millions peoples (14 % Vietnam population). Often in these areas, farmers are poor and high venerable.

In Vietnam, sandy soil are distributed mainly in central coastal provinces including Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien-Hue, Ninh Thuan, Binh Thuan and along some big river sides where soil developed in situ derived from sandstone and granite rocks. According to Vietnam soil association (1996), the Vietnamese group of sandy soils may be classified mainly into 3 units: white and yellow sand dune soils; red sand dune soils and sandy marine soils. In this case study, we report the results collected from different studies on sandy and light textured soil management in Vietnam including a cooperation project with Belgian universities focused on coastal sandy soils of Central Vietnam and a North Vietnam sandy soils monitoring project.

5.1 Vietnam Sandy Soil fertility status

Beside two alluvial soils of Vietnam (Red river fluvial soil and Mekong river fluvial soil), soil fertility in Vietnam is not very high. The widespread soils in Vietnam have low pH, low C, low N and very low CEC. It is especially true for soil with light texture as sandy soil or acrisol. The dominant feature of the central coastal sandy soil (Haplic Arenosol) was shown in the Table 9. Results of routine soil testing conducted recently reveal that, most of Vietnamese sandy soils had low organic matter content. All of studied soil samples are deficient in N, P, Ca and 50% in Mg.

In farming, the strategies of farmers are different from scientists. The dominant criteria to scaling up the scientific finding is increasing the soil productivity and therefore increasing income for farmers. The approach to improve the carbon stock in soils should be an integrate approach where the interest of the farmers in short and medium term should be firstly considered.

5.2 Soil acidity and organic content in soil as key limiting factors

Light texture is considered as key factor limiting soil productivity but it is not easy to increase clay content of sandy soil. Acidity and organic content are usually cited as two main critical chemical characteristics when managing sandy soils. Acidity of sandy soils depends on type sandy soil formation and profile. Generally, sandy soils are acidic with the pH_{KCl} below 5 but in particular cases, pH_{KCl} of Vietnam sandy soil may reach more than 6.0 units. For the organic carbon content, analysing 300 cultivated sandy soil samples from Thua Thien Hue province, results showed a very large variation of organic content. The average was 1.08 with the standard deviation of 0.67. Both acidity and organic content of sandy soil may be influenced by agronomy activity, water logging condition, rate of organic material mineralization and sea water intrusion. Figures 3 showed pH and organic content (OC) distribution of sandy soils in Thua Thien Hue province.

Table 9: Selected physico-chemistry of representative Vietnam sandy soil

No	Item	Unit	Mean	Std	n
1	pHH2O		4.61	0.48	75
2	pHKCl		4.10	0.47	75
5	Bulk density	$gram/cm^3$	1.51		24
6	Density	$gram/cm^3$	2.65		24
7	Porosity	%	43.0		24
8	Texture				
	2-0.2mm	%	66.60	18.15	75
	0.2-0.02mm	%	19.85	10.26	75
	0.02-0.002mm	%	7.08	6.35	75
	<2mm	%	5.59	5.36	75
10	OC	%	1.08	0.67	300
11	CEC	cmolc/kg	4.52	3.79	75
12	Ca^{++}	cmolc/kg	0.69	0.74	75
13	Mg^{++}	cmolc/kg	0.25	0.36	75
14	K^{+}	cmolc/kg	0.03	0.16	300
15	Na^{+}	cmolc/kg	0.28	0.79	75
16	Al^{3+}	cmolc/kg	0.59	0.67	75
17	H^{+}	cmolc/kg	0.06	0.09	75
19	N	%	0.06	0.03	300
20	P	%	0.02	0.01	300
21	K	%	0.18	0.24	75
22	P (bray II)	mgP/kg	28.8	21.9	75

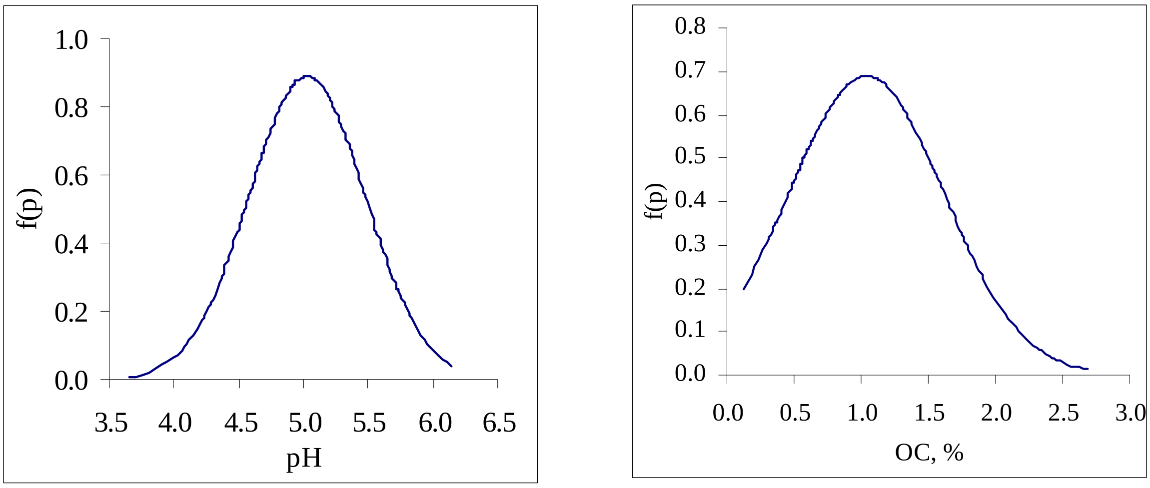

Fig. 3 Density function of OC (right) and pH (left) of sandy soil as indicated by Normal distribution

5.3 Management of sandy soil in Vietnam is usually sequenced in different steps.

5.3.1 Land use planning

Land use planning is probably the first important step in managing sandy coastal areas and sandy soil. Topography of sandy coastal soil may be distinguished by flat forms or moving dunes; flat sandy with coarse grain layers are managed to foods and different foodstuff crops; while moving dune sandy with fine grain is most difficult to manage. Normally, government takes firstly action. Land use planning should be realized at different scales, both at regional and farm level. Land management at regional or provincial level may follow national program approach such as afforestration program, national action plan for anti-desertification or eradication of poverty campaign. At farm level, farmer should adapt and analyze what may fit the family's requirement in food and in cash and it depends on their capital and labor capability. It depends also on local weather condition and the variation of the market. Farmers' decision is very much influenced by their need in food. At the country level, Vietnam is at safe food security but it is not true for every household in coastal areas. It is suggested that in such case land use planning should go through participatory way that involves both the need and the capability to make action both by authority and inhabitants. Study reported by Nguyen Thuc Thi (2003) showed an example of sandy soil use planning projection by 2010 for three provinces in central coast where dominated sandy soils (Table 10).

5.3.2 Field engineering and management

About 27% of sandy areas are not still used (Vu Nang Zung et al., 2005). There are several reasons, but one of them is the area is not yet managed. It is clearly agreed that, water field engineering including canal irrigation and drain system, making ridges, reforest tree for fixing moving sandy soil are most important key works. Management in sandy soil should be involved both water management together with forestry and agriculture management (Phan Lieu, 1981).

5.3.3 Choice of suitable crops and cropping systems

Choice of suitable crops and cropping sequence are often very delicate. Casunarina (*Casuarina equisetifolia*), Eucalyptus (*Eucalyptus sp*), Photina (*Phitinia prunifolia*), Kapok tree (*Alba pentandra*), Guava (*Psidium guajava*/ *Myrtacea*), Jack fruit (*Artocarpus heterophyllus*); Vetiver (*Vestiveria sp*) are frequently cited as plant species that can firstly grown on sandy and using as fixing tree for wooden, fuel, fruit or medicinal purposes.

Cashew (*Anacardium occidentaleL/ Anacardiacea*); Mango (*Mangifera indica L*), Coconut (*Cocos nucifera L)*, Dragon Fruit Tree (*Hylocereus undatus*), Citrus/ Citron Orange (*Cistrus reticulata Blanto*) are also adapted and grown in some coastal area. These trees were very well developed on sandy soils with a good cultural practice such as fertilization for cashew, lighting regulation for dragon fruits.

Table 10. Sandy soil use planning projection in 2010 for three provinces (Quang Binh (QB), Quang Tri (QT), Thua Thien Hue(TTH)).

Land use type	Total (ha)	%	QB (ha)	QT (ha)	TTH (ha)
Rice-Rice	11,150	9.4	3,000	1,750	6,400
2Rice + 1cash crop	1,000	0.8	200	500	300
1Rice + 2cash crops	1,900	1.6	1000	700	200
Rice + cash crop	1,250	1.1	700	400	150
Cash crop only	6,000	5.1	1000	2500	2500
Perennial/ fruit tree	250	0.2	150	50	50
Fishery_ Shrimps	550	0.5	100	100	350
Forestry					
Eucalyptus, Casunarinas	72,104	60.8	25,512	21,782	24,810
Total	118,504	100	37,162	34,582	46,760

Source: Nguyen Thuc Thi, 2003

Permanent dry sandy soils may be used for cash crops such as peanut, maize, sesame while seasonal or permanent flooding areas are very well for rice crops. Tables 11 and 12 showed different land use types in Vietnam sandy soil, yield and its economical values. Fishery seems as most interesting for maximization economical return but this type of land use counts only 0.14%. Forestry is at the lowest economical value land use type and it counts 27.1%. Rice based cropping dominates still all types of sandy land uses.

Table 11: Cropping system in Vietnam sandy soil by 2004

Crops	Percentage
Rice- Rice	7.8
1 Rice	0.9
1 Rice- 1 cash crop	8.2
Cash crop only	13.5
Fruit and perennial tree	5.0
Fishery	0.14
Forestry	27.1
Others	10.5
Total used	72.5
Non used	27.5

Source : Vu Nang Zung et al. 2005.

Table 12: Detail of crop yield and cash value equivalent

Crop/items	Yield range (ton/ha/year)	Cash value in Vietnam 10^6\$/ ha/year
Spring rice(1)	4-6	8 - 12
Summer Rice(1)	3-5	6 - 10
Peanut(1)	1.2-1.8	0.96 – 1.4
Soybean(2)	4.0 – 6.5	3.5 – 5.7
Sesame(1)	0.8-2.3	16 - 46
Maize(1)	2.5-3.5	3.8–5.3
Sweet potato(2)	2.48 – 18.2	2.5 – 18.2
Cassava(2)	4.7 – 22.2	5.6 – 26.6
Dragon fruit(2)	15 -30	90 – 180
Cashew(2)	1.0-1.5	17 – 25.5
Vegetable(1)	30-50	30 - 50
Shrimps(2)	0.9 - 30	9 - 300
Salt field(2)	45000 - 90000	15.8 - 36

Source: (1). Pham Quang Ha, 2005 (un publised data)
(2). Statistical data in Website: http://www.mard.com.vn

6. Multipurpose approaches for increasing soil productivity and carbon stock

Integrated nutrient management is the efficient use of all types and forms of nutrients, both those originating from the field or farm and those from outside the field or farm (Nguyen Van Bo et al. 2003). Balanced fertilization achieved when the cropping system is supplied with the correct proportions of N, P, K, Mg and other nutrients. Further more, in soils can be improved considerably in using crop residues and best practice for land preparation.

There are four main integrating approaches to improve soil productivity and carbon stock in soils:

- Plant crops adapted to indigenous soil nutrient supply
- Improve the soil fertility to meet the crop's requirement
- Fertilization with organic and inorganic materials
- Using crops residues and minimized tillage.

Crop residue management and farm yard manure is a subject to study and to practice in Vietnam especially for light texture soil. Returning crop residues to soil improves significantly soil physical and chemical properties. However, inappropriate agricultural practices and continuous cropping without adequate nutrient are occurring in many places. The management of sandy soils requires particularly integrated practices that can increase fertility, and the nutrient and water holding capacity. Biological management of the soils can be an effective way to increase soil quality through management of biomass, i.e. farmyard manures, crop residues, green manures, and alley cropping. In addition, the effective management of the soils needs careful consideration of appropriate techniques, not only to address the issue of low productivity, but also to protect the environment such as nitrate leaching, heavy metals accumulation for examples. Synthesis study (Table 13) from National Institute for Soils and Fertilizers (NISF, Hanoi, 1996-2000, un published data) showed clearly crops yields in sandy soils as affected by farm yard manure. Crop yield increased by 158-200% as compared with control treatments. In practice, different types of green or farm yard manures are used.

In Thua Thien Hue provinces par examples farmers used buffalo manure, chicken manure, pig manure or plant residues such as rice straws and ash (Table 14).

Table 13. Crop yield (tone /ha) as affected by Farm yard manure (FYM)

Treatment	Sesame	Peanut	Rice	Maize
N P K	0.6 (0.2)	1.2 (0.5)	2.5 (0.3)	1.8 (0.2)
N PK + FYM	1.2 (0.4)	1.9 (0.3)	4.3 (0.6)	3.4 (0.3)
Percentage (%)	200.0	158.3	172.0	188.8

Source: NISF, unpublised data (1996-2000)

Table 14. Carbon and nutritive values of selected materials considered as input for fields (expressed in dry matter)

Types of materials	*N. of samples*	*C %*	*N %*	*P%*	*K%*
Buffalo manure	*14*	*11.7*	*0.64*	*0.16*	*0.33*
Cattle manure	*8*	*17.8*	*0.95*	*0.24*	*0.62*
Pig manure	*33*	*19.2*	*1.23*	*0.38*	*0.54*
Chicken manure	*6*	*14.2*	*1.36*	*0.60*	*0.40*
Duck manure	*5*	*10.9*	*10.9*	*0.24*	*0.41*
Plant residues	*22*	*38.8*	*1.61*	*0.17*	*0.39*
Ash	*5*	*3.9*	*0.25*	*0.35*	*1.34*

Source: Hoang Thi Thai Hoa (2008)

7. Conclusion

The paper presented here is based on a synthesis approach showed organic carbon content in main group of Vietnam soil under agricultural activities. Vietnamese experiences on sandy soil management to improve soil productivity as well as carbon stock in soil were also discussed. As the situation is complex , improvement carbon stock in light soil textures, low carbon content such as sandy soil needs not only logistic input but also time consuming for biological process. The management of these soils requires integrated practices that can increase fertility, and the nutrient and water holding capacity of these soils. Biological management of these soils can be an effective way to increase soil quality through management of biomass, i.e. farmyard manures, crop residues, green manures, and alley cropping. In addition, the effective management of these soils needs careful consideration of appropriate techniques to address not only the issue of low productivity, but to also protect the environment. These soils are liable to significant losses of nutrients through leaching, so that any intensification of production needs to recognize this potential adverse effect and develop management strategies that minimize off-site pollution. These technologies need to be assessed in pilot demonstration plots under local conditions prior to recommending their adoption by the wider agricultural community. Policy to improve carbon stock in soils should go together with the improvement of the farmers’ livelihood.

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