PROSA: Sector-Based Project for Agroecology Development

Definition and Content of the Agro ecology and Conservation Agriculture Teaching in Faculties and Colleges of Agriculture in Lao	
Faculties of Agriculture	Colleges of Agriculture
Objective**: Introduction of a complete Agro ecology & Conservation Agriculture teaching course in Education Cursus.**	Objective**: Introduction of a practical Agro ecology & Conservation Agriculture teaching course in their curricula.**
- Module 1: Definition of Agro ecology, Conservation Agriculture and SCV (Direct seeding on plant cover). ***Objective****:* to explore the science of agro ecology as a conceptual and practical interface that links agricultural production to natural resources. ***Students will gain theoretical and practical knowledge about the following:*** o Agroecology as a scientific discipline to study interactions of all important biophysical, technical and socioeconomic components of farming systems; o Conservation agriculture as an agro ecological approach associating rural development with environmental preservation. It is a generic concept integrating the whole agricultural practices & aiming both at viability and sustainability of agriculture and environment protection. o Direct seeding as a technique to place seeds in condition to sprout directly in untilled soil either on bare soils or on plant cover soils. Direct seeders are able to sow according to this principle. o General overview of the evolution of conservation agriculture in the world. o Management of agro ecosystems and sustainable agriculture – Global change and options for global environmental management. Climate change in relation with Greenhouse Effect Gas emissions (GEG), land use change and biodiversity loss, environmental pollution and land degradation.	**- Module 1. Definition of Agro ecology, Conservation Agriculture and SCV (Direct seeding on plant cover);** ***Objective***: to provide clear understanding between the science of agro ecology, the application of these sciences in Conservation agriculture and the techniques (SCV) to implement conservation agriculture to both improve agricultural production and to protect natural resources. ***Students will gain practical knowledge about the following:*** o Agroecology as a scientific discipline to study interactions of all important biophysical, technical and socioeconomic components of farming systems; o Conservation agriculture as an agro ecological approach associating rural development with environmental preservation. It is a generic concept integrating the whole agricultural practices & aiming both at viability and sustainability of agriculture and environment protection. o Direct seeding as a technique to place seeds in condition to sprout directly in untilled soil either on bare soils or on plant cover soils. Direct seeders are able to sow according to this principle. o General overview of the evolution of conservation agriculture in the world. o Management of agro ecosystems and sustainable agriculture – Global change and options for global environmental management. Climate change in relation with Greenhouse Effect Gas emissions (GEG), land use change and biodiversity loss, environmental pollution and land degradation.

- Module 2: Diagnosis of Agricultural production and landscape management. ***Objective:*** Develop methodological tools to analyse landscapes with constraints and potentials of prevailing cropping and livestock production system. ***Students will gain basic knowledge about the following:*** o Landscapes analysis, agricultural production systems analysis; o Soil fertility assessment (physic, chemical, biological), water and mineral nutrition, rooting development o Interaction of soil fertility & crop development; o Evaluation of soil erosion risks; o Evaluation of the biodiversity (plant & soil fauna analysis…); o Role of cultural practices on soil fertility; o Role of Indigenous knowledge of farmers in traditional and modern agriculture; o Analysis of influencing factors as economy, politics, land tenure & other social issues. ***Fields visits & excursion in different regions where Conservation Agriculture is practiced.***		**- Module 2: Diagnosis of Agricultural production and landscape management.** ***Objective:*** Presentation of tools to analyse landscapes with constraints and potentials of prevailing cropping and livestock production system. ***Students will gain basic knowledge about the following:*** o Quick approach of the soil fertility assessment (physic, chemical, biological), water and mineral nutrition, rooting development o Interaction of soil fertility & crop development; o Evaluation of soil erosion risks; o Information about the biodiversity (plant & soil fauna analysis…); o Role of cultural practices on soil fertility; o Role of Indigenous knowledge of farmers in traditional and modern agriculture; o Analysis of influencing factors as economy, politics, land tenure & other social issues. ***Fields visits & excursion in different regions where Conservation Agriculture is practiced.***	
- Module 3: General Principles of Conservation agriculture & its impacts on soils, production & environment. ***Objective:*** Understand the principle of the conservation agriculture and be able to analyse the difference between CA and conventional agriculture in terms of soil fertility, production and environment protection. ***Students will gain theoretical and practical knowledge about the following:*** o Principle N°1 of CA: Practicing minimum disturbance of the soil (no tillage); o Principle N°2 of CA: Keep the top soil permanently cover;		**- Module 3: General Principles of Conservation agriculture & its impacts on soils, production & environment.** ***Objective:*** to master the implementation of conservation agriculture. ***Students will gain theoretical and practical knowledge about the following:*** o Principle N°1 of CA: Practicing minimum disturbance of the soil (no tillage); o Principle N°2 of CA: Keep the top soil permanently cover; o Principle N°3: Practicing crops rotations; o Understanding the Soil Organic Matter (SOM):	

o Principle N°3: Practicing crops rotations; o Understanding the Soil Organic Matter (SOM): ▪ Chronological evolution of the SOM; ▪ The SOM origin; ▪ The transformation of crop residues and animal detritus in SOM; ▪ The form of SOM protection (Physical, chemical, mineralogy); ▪ The global SOM pools; ▪ Models of aggregates formation (links with no tillage and SOM). o Understanding the Carbon cycle in terrestrial environment: ▪ Soil Organic Carbon (SOC) pools (active and stable fractions – concepts & formation of the humic substances; ▪ Characteristics & functionality of the SOC pools; ▪ Microbial biomass – activity, functionality & interaction with cropping system. o The approach of direct impact of conventional soil tillage in the Organic matter & carbon losses ▪ Losses of soil organic matter due to tillage & mono cropping; ▪ SOM dynamics in Conservation Agriculture; ▪ Carbon and nitrogen storage – Carbon & Nitrogen balance in no-tillage; ▪ Impact of intensive cropping system to carbon storage (sequestration) & mitigate CO2 emissions; ▪ The contribution of the carbon from crop residues. o Understanding the biological interactions with aggregates formation: ▪ The contribution of the micro & macro flora to the aggregates formation; ▪ The mechanism of aggregates formation & the relationship with crop residues.		▪ Evolution of the SOM in the soil; ▪ The SOM origin: ▪ The transformation of crop residues and animal detritus in SOM. o Information about the Carbon cycle in terrestrial environment: o The approach of direct impact of conventional soil tillage in the Organic matter & carbon losses ▪ Losses of soil organic matter due to tillage & mono cropping; ▪ SOM dynamics in Conservation Agriculture; ▪ Carbon and nitrogen storage – Carbon & Nitrogen balance in no-tillage; ▪ Impact of intensive cropping system to carbon storage (sequestration) & mitigate CO2 emissions ▪ The contribution of the carbon from crop residues. ***Fields and lab Practices:*** o Soil sampling practice for no-tillage and cropping systems (disturbed & undisturbed samples…); o Determination of the bulk density: o Dry-sieving of crop residues to understand the OM decomposition; o Overview of the impact of different cover crops in the aggregates formation; o Interpretation of laboratory results;	

Fields and lab Practices: o Soil sampling practice for no-tillage and cropping systems (disturbed & undisturbed samples…); o Determination of the bulk density: o Dry-sieving of crop residues to understand the OM decomposition; o Preparation of soil samples to analyse soil aggregates; o Effect of different cover crops in the OM decomposition & in the soil aggregation – root effect – microbial effect – protection of aggregates; o Methodology to assess the impact of different cover crops in the aggregates formation; o Calculations of carbon & nitrogen storage; o Interpretation of laboratory results; o Models of carbon turnover in relation with no-tillage and cropping systems;			
- Module 4: Implementation of Conservation agriculture - Farming Techniques **Objective:** Understand the main techniques to implement conservation agriculture ***Students will gain theoretical and practical knowledge about the following:*** o Planters and sowing quality to no-tillage: ▪ Planters & indicators for sowing quality; ▪ Different planters for no-tillage. o The use of cover crops/multipurpose species: ▪ Soil improvement;		**- Module 4: Implementation of Conservation agriculture - Farming Techniques** **Objective:** Understand the main techniques to implement conservation agriculture ***Students will gain theoretical and practical knowledge about the following:*** o Planters and sowing quality to no-tillage: ▪ Planters & indicators for sowing quality; ▪ Different planters for no-tillage. o The use of cover crops/multipurpose species: ▪ Soil improvement;	

▪ Preferential nutrients recycling; ▪ Weeds and pest management (nematode, cryptogamic disease…); ▪ Quality and quantity of dry matter (above and below ground); ▪ How to generate additional income and resource (fodder and cash)? ▪ How to manage the cover crops? Choice of species; ▪ Integration with livestock production. o The control of weeds: ▪ Overview of the three methods to control weeds; mechanical, chemical and biological; ▪ Spraying technology quality; ▪ Weeds control through crops rotation; ▪ Cover crops management & interactions with weeds & disease control. ▪ Allelopathy and weeds management. ***Fields and lab Practices:*** o Demonstration of SCV techniques. o Use of machinery (sowers, rollers knife, sprayers…). o How to create CA- Direct sowing and combine a large range of crops		▪ Preferential nutrients recycling; ▪ Weeds and pest management (nematode, cryptogamic disease…); ▪ Quality and quantity of dry matter (above and below ground); ▪ How to generate additional income and resource (fodder and cash)? ▪ How to manage the cover crops? Choice of species; ▪ Integration with livestock production. o The control of weeds: ▪ Overview of the three methods to control weeds; mechanical, chemical and biological; ▪ Spraying technology quality; ▪ Weeds control through crops rotation; ▪ Cover crops management & interactions with weeds & disease control. ***Fields and lab Practices:*** o SCV techniques – use of machinery (sowers, rollers knife, sprayers…): ▪ Demonstration of SCV techniques for students and local farmers. ▪ Extensive training to the planters, roller knife and sprayers equipments.	
- Module 5: Economy and environmental benefits of Conservation Agriculture and adoption process **Objective:** Assess, **a**nalyse and understand the impacts of the conservation agriculture on the production and environment at different scales (farm, village community, landscape and macro level). ***Students will gain theoretical and practical knowledge about the following:***		**- Module 5: Economy and environmental benefits of Conservation Agriculture and adoption process** **Objective:** Assess, **a**nalyse and understand the impacts of the conservation agriculture on the production and environment at different scales (farm, village community, landscape and macro level). ***Students will gain theoretical and practical knowledge about the following:***	

o Economic advantages of Conservation Agriculture at field, farm and landscape level; o Cumulated economic benefits at regional level; o Implementation costs; o Environmental benefits (biodiversity, land degradation, carbon sequestration); o Social consideration and main determinants for adoption. ***Fields and lab Practices:*** Students will do work experience (1-3 months) in selected Research & Development programmes to implement diagnosis and identify solutions to implement CA: o Use of methodological tools (landscape analysis, agricultural production systems analysis, interviews) to carry out a group work.; o Meeting with different stakeholders to understand the agricultural, economic and environmental characteristics of this area; o Inquiring different groups other stakeholder to analyse specific question such as constraints and potentials of the prevailing cropping and livestock production systems or landscape management system; o Analyse the role of rural tourism, potential conflict issues such as nature conservation or water contamination, and rural development policy; o Critical analysis of influencing factors such as economy, politics, land tenure or social issues.		o Economic advantages of Conservation Agriculture at field, farm and landscape level; o Implementation costs; o Social consideration and main determinants for adoption. ***Fields and lab Practices:*** Students will do work experience (1-3 months) in selected Research & Development programmes to implement diagnosis and identify solutions to implement CA: o Use of methodological tools (landscape analysis, agricultural production systems analysis, interviews) to carry out a group work.; o Meeting with different stakeholders to understand the agricultural, economic and environmental characteristics of this area; o Inquiring different groups other stakeholder to analyse specific question such as constraints and potentials of the prevailing cropping and livestock production systems or landscape management system;	