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POSTER ABSTRACTS

Status and Best-Bet Entry Points for Business mModels that Accelerate Initiatives to Scale-up Kenya's Conservation Agriculture Development

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Background

Conservation Agriculture (CA) advancement, efforts and reach in Kenya

A number of CA promotional activities have taken place in Kenya since 2002. The 3rd World Congress in Conservation Agriculture hosted by Kenya in Nairobi in October 2005 saw an increase in CA promotional activities with a number of CA based organizations and projects being initiated. In spite of these efforts, only about 40,000ha of farmland is estimated to be under some form of CA in Kenya to date. Evidence of CA is visible in areas where NGO-led and some government department's efforts have had impact. More players are coming on-board frequently but adoption rates remain low. The low state of CA adoption is attributed to a number of things among the key ones being lack of appropriate equipment, inadequate and often conflicting information, lack of institutional, policy and financial support to lessen costs associated with adoption. Notably, uptake is highest amongst the wealthier farmers and commercial producers who, by virtue of their relative wealth and knowledge/information, can afford to take risks, as opposed to risk-averse poor farmers.

Nearly all CA promotional activities have been donor driven through projects and has taken the form of awareness creation, capacity building, and inputs support to organised farmer groups. Without appropriate policy environment, institutional support and sound business orientation the impact and sustainability of these efforts will continue to be low. However, the impacts of climate change are persuading African leaders to take more interest in mitigation measures, with calls to adapt climate-smart agriculture becoming lauder. More and more donors, governments, regional intergovernmental entities, international and local NGOs are coming up with mega-projects to roll out CA. New innovative approaches are being fronted to guarantee sustainability of efforts, avoiding the pitfalls of the past.

Innovative Approaches

It is recognised that new CA promotional approaches must embrace a "business approach" mode along the CA value chains if they are to be sustainable. Innovative technology roll-out models currently being tried include Innovation Platforms (IPs), Commercial Villages, Agribusiness hubs and one-stop shop concept. Outlined in this paper (fig 1) is a more comprehensive and pragmatic "Centre of Excellence" combining elements of the above mentioned models. It incorporates sound business models with a strong private sector involvement to support market systems and create linkages to output markets. This approach oversees technology and service delivery in an environment that sees the farmers grow, make business deals and meet their supporters on equal footing.

Application and Implications for Conservation Agriculture

The Centre of Excellence will make services available and affordable, increase CA uptake as farmers do not have to own expensive equipment to practice CA, make farming more attractive, create job opportunities to the youth, add value and link farmers to markets, thus ensuring income generation and food security.

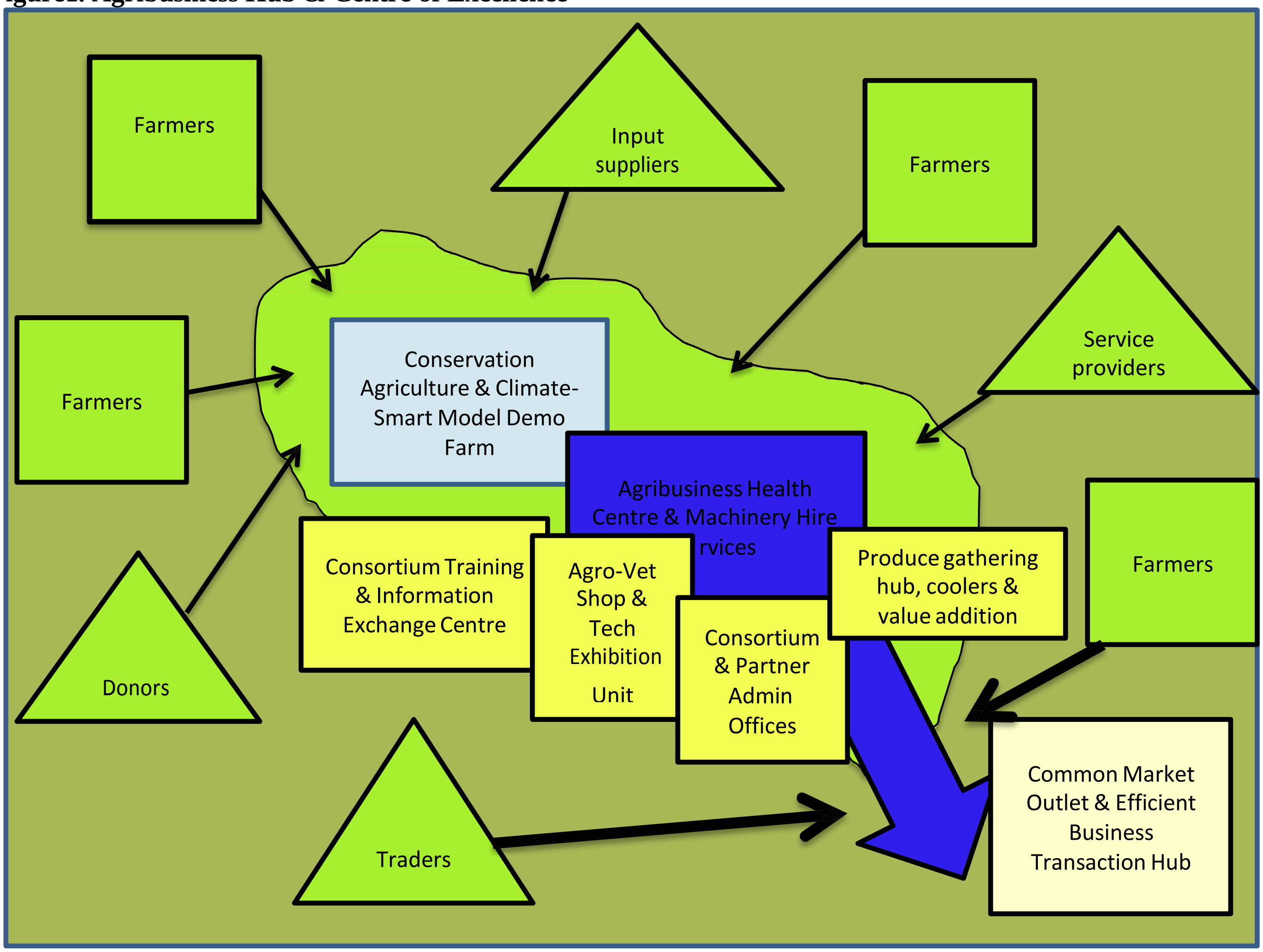
Experimental Approach

"Best-bet" CA technologies with specific focus on 2WT CA technologies are being evaluated both on-station and on-farm to validate them under local conditions, borrowing from experiences from India, Bangladesh, Brazil and China. Successful best-bet(s) will be placed at the Centre of Excellence for access by farmers through commercialized equipment hire services. Links with private sector will ensure inputs availability and after-sales support for private ownership as well as support to the centre in terms of supplies, maintenance and spare parts. Information and training support will be provided through the centre. Two sites in Laikipia and Bungoma in Kenya are being set for this model. If successful, as is expected, the model will be rolled out in other parts of the country.

Expected results

The first Centre of Excellence, in its initial stages of development in Ngushishi, Laikipia in Kenya, is already attracting a lot of attention with many enquiries being made by prospecting stakeholders, among them farmers, entrepreneurs such as equipment suppliers, NGO's and local leaders. It is expected, once fully operational, the centre will greatly accelerate uptake of technologies such as Conservation Agriculture and create business opportunities along the entire CA value chains.

Figure1. Agribusiness Hub & Centre of Excellence



References.

Baudron , F. 2013. Farm power and conservation agriculture for sustainable intensification.

K'Owino Isaac, O. 2010. Conservation Agriculture in Kenya. Analysis of past performance and emerging trends.

Kaumbutho, P.G. 2014. Market Analysis and early activities on business model development in Kenya.

Conservation Agriculture Techniques in Rainfed Tree Crops and Mediterranean Climate: Implications for Erosion and Runoff Control

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Introduction

In the Mediterranean area land degradation is becoming progressively more important due to deterioration in the quality of land in terms of its capability to support land uses (Salvati and Carlucci, 2013). Soil erosion is one of the main physical processes of land degradation, and in Spain is important in both its economic costs and the environmental negative effects (Durán et al., 2013).

The Alpujarras is a deep valley region running parallel to and south of the crest of the Sierra Nevada in Mediterranean southeast Spain. Soil erosion in the zone is one of the most damaging effects of human activity today and it is accelerated by their actions, particularly through farming. Great efforts have been made to reduce soil degradation from cropland and to minimize off-site impacts by reducing erosion and surface runoff within fields (Durán et al., 2008, 2009).

Conservation agriculture is a system of agronomic practices that include reduced tillage or no-till, permanent organic soil cover by retaining crop residues, and crop rotations, including cover crops. In this context, cultivating crops in strips running across the slope can reduce the risk of erosion by cutting surface water runoff. In Spain, 18.1% of the land (more than 9 million ha) registers soil losses higher than 50 t ha^{-1} yr^{-1} being the distribution of these soil erosion rates different, depending on the land use or type of vegetation cover. That is, in woody dryland crops such as vineyards (*Vitis vinifera*), almond (*Prunus amygdalus*) and olive trees (*Olea europaea*), the erosion rates are around 95 t ha^{-1} yr^{-1}, in herbaceous dryland crops they are about 36 t ha^{-1} yr^{-1} and scrubland and pasture, the average value is 21 t ha^{-1} yr^{-1} (ICONA, 1991).

The main aim of this study was to analyze the application of conservation agriculture strategies based in different soil-management systems: minimum tillage with plant strips (*Hordeum vulgare* and *Vicia sativa*) and minimum tillage without plant covers, and its effects on soil erosion and runoff from hillslope in a vineyard orchard in SE Spain.

Material and Methods

The study was conducted in Lanjarón Granada (SE Spain) at location whose UTM coordinates are N36º 53´54.87´´ W 3º 29´37.31´´and at elevation of 460 m. The soils are Typical Xerorthent, with loamy texture of 54% sand, 27% silt and 19% clay, containing 1.3% of organic matter, and 0.12% N, with 14.6 mg kg^{-1} P and 56.7 mg kg^{-1} available K.

The area selected for the study is the part of the rainfed orchard given entirely with vineyard (*Vitis vinifera* cv. Tempranillo); the planting grid was 1.5 x 3 m. The erosion plots with twelve plants each were located on a hillslope at 20% incline and 56 m^2 (14 x 4 m) of area. Each erosion plot consisted of a galvanized enclosure, drawer collector, sediment and runoff collectors, which were cleared after each erosive event (Figure 1).

There were three types of erosion plots, with minimum tillage and cover-crop strips of *Hordeum vulgare* (MTHV) and *Vicia sativa* (MTVS), and minimum tillage without plant covers (MT), all replicated twice. Two strips of 2 m width were planted between the rows of vineyard, the strips run perpendicular to the slope in order to trap eroded soil and reduce the runoff across the hillslope.

During the monitoring period the soil loss and runoff from plots were collected and measured. For each storm, average intensity [I = (Total rain/total time) (mm h^{-1})] and maximum intensity at 30 min (I_{30}) were calculated. By analysis of variance, the means of different effects of cover-crop strips were compared, and differences between individual means were tested using the LSD test at $p < 0.01$.

Results and Discussion

A total of 13 rainfall events were recorded during the monitoring period ranging from 11.0 to 62.3 mm, and maximum rainfall intensity at 30 min from 1.2 to 11.2 mm h^{-1}, displaying high annual and inter-annual contrasts in quantity and intensity. In this sense, Figure 2 shows the variability of soil erosion and runoff response to soil-management strategies studied. Table 1 presents the results for the analysis of the variance concerning the effect of three soil-management systems on the average soil erosion and runoff, being these values not different significantly among studied strategies. In this sense, according to Ferrero et al. (2002) conventional tillage and cover crops systems for the same area in vineyards produced 2410 and 480 kg ha^{-1}, and runoff 56.5 and 26.4 mm, respectively.

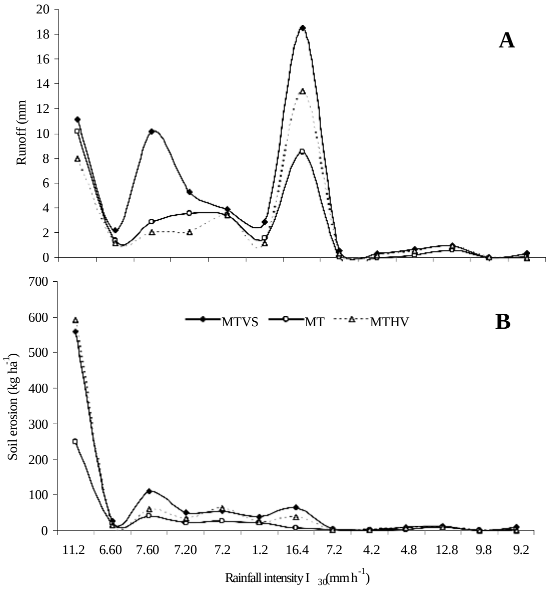

Figure 2. Runoff (A) and soil erosion (B) rates in relation to rainfall intensity

Although in this preliminary stage, the trend in controlling the erosion and runoff was more effectively in the minimum tillage without plant strips.

In general, the minimum tillage and the combined techniques in vineyard orchards allowed reducing soil erosion and surface runoff, improving the interception of the rainfall water, and consequently increasing the available water. The reduction of erosion and runoff rates was more than 50% inrelation to conventional tillage in the study area. Thus, the application of conservation agriculture techniques is essential for an understanding of productivity of soil undergoing erosion, since sustainable planning can mitigate soil-degradation processes in the overall agricultural marginal areas.

Table 1. Mean soil erosion and runoff for a storm event

Soil-management system	Soil erosion (kg ha^{-1})	Runoff (mm)
MT	2.5a	30.9a
MTHV	2.6a	64.9a
MTVS	4.4a	72.6a

Different letters are statistically different al level 0.05 (LDS)

Acknowledgement

This study was sponsored by the following research project "Conservation agriculture techniques in rainfed-tree crops and Mediterranean climate: implications for sustainable productivity, erosion control, and improvement of soil quality and biodiversity" (RTA2011-00007-00-00) granted by INIA, Spain and cofinanced by FEDER funds (European Union).

References

Durán, Z.V.H., P.C.R. Rodríguez, M.J.R. Francia, R.A. Martínez, P.L. Arroyo, and R.B. Cárceles. 2008. Benefits of plant strips for sustainable mountain agriculture. Agron. Sustain. Develop. 28: 497-505.

Durán, Z.V.H., P.C.R. Rodríguez, P.L. Arroyo, M.J.R. Francia, and R.B. Cárceles. 2009. Soil conservation measures in rainfed olive orchards in south-eastern Spain: impact of plant strips on soil water dynamics. Pedosphere 4: 453-464.

Durán, Z.V.H., M.J.R. Francia, T.I. García, and T.S. Cuadros. 2013. Implications of land cover types for soil erosion on semiarid mountain slopes: towards sustainable land use in problematic landscapes. Acta Ecol. Sinica 33: 272-281.

Ferrero, A., L. Lisa, S. Parena, and L. Sudiro. 2002. Runoff and soil eroison from tilled and controlled gras-covered vineyards in a hillside catchment. ERB and Northern European FRIEND Project Conference, Demänosvska dolina, Slovakia.

ICONA. 1991. La erosión en España. Síntesis, Madrid, Spain.

Salvati, L. and M. Carlucci. 2013. The impact of Mediterranean land degradation on agricultural income: A short-term scenario. Land Use Policy 32: 302-308.

Evaluation of Conservation Agriculture for Rice-based Cropping Systems on the High Ganges River Flood Plain of Bangladesh

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Background:

Cropping systems on the High Ganges River Flood Plain of Bangladesh are highly diverse and usually include puddled transplanted rice (T. aman) in the rainy season. However, the sustainability of these systems is threatened because: (i) establishment of T. aman is costly because of intensive tillage (high fuel consumption) and the high labor requirement for transplanting, (ii) puddling for rice damages soil structure, which impairs the performance of non-rice crops in the rotation, and (iii) groundwater levels are declining because of pumping in the dry season, especially for transplanted boro rice (T. boro). Therefore, an experiment was initiated to evaluate the effects of changing from the conventional aman-boro system to an aman-wheat-mung system with reduced tillage and partial retention of aman residues.

Experimental approach:

A replicated experiment was conducted on a clay loam soil at Jessore. Four cropping system/establishment methods (CSE) were compared in 9 m x 22 m main plots: CSE1: T. boro-T. aman (control), CSE2: wheat-mungbean-T. aman (wheat and mungbean sown using a power tiller-operated seeder, PTOS, with full tillage, puddled transplanted aman), CSE3: wheat-mungbean-DS aman (dry-seeded rice (DSR), wheat, and mungbean all sown using PTOS with conventional tillage), and CSE4: wheat-mungbean-DS aman (all sown using PTOS with strip tillage). Two levels of rice residue retention (aman residues removed; partial retention: 40 cm of standing stubble) were compared in sub-plots. Rice water management was continuous flooding (CSE1) and safe alternate wetting and drying (AWD) (CSE2-4, 15 kPa soil tension at 15-cm depth). The site had not previously grown puddled transplanted rice.

Results

Rice equivalent yield of all wheat-mungbean-aman systems (CSE2-4) was significantly higher than that of T. boro-T. aman (CSE1) in the first year, and when averaged over the first 2 years (Fig. 1A). Aman rice residue retention gave significantly higher yield than residue removal in the second year, and when averaged over the first 2 years (Fig. 1B).

The flooded T. boro-T. aman (CSE1) system used much more irrigation water than the other systems (Fig. 2A). For aman rice grown with safe AWD, changing from puddling and transplanting (CSE2) to dry seeding (CSE3,4) reduced total system irrigation input by an average of 46% (619 mm). Aman residue retention significantly reduced system irrigation input in the 2nd year (Fig. 2B).

Irrigation water productivity (WPI) was highest in the wheat-mungbean-DS aman systems (CSE3,4), with no difference between conventional and strip tillage after 2 years (Fig. 3A). Rice residue retention also gave a small but significant increase in WPI (Fig. 3B).

Discussion:

Reports on the relative performance of DSR and PTR show variable results (e.g. Gathala et al. 2011; Sudhir-Yadav et al. 2011). The causes of the variable performance have not been clearly established. In our study, yields of both establishment methods were similar, consistent with the findings of Sudhir-Yadav et al. (2011) who also compared DSR and PTR on a clay loam soil with safe AWD water management. Yield of wheat declined after only one year of puddling on this soil which had not previously been puddled. Along similar lines, other studies show that on soils with a history of puddling, yields of wheat start to improve after 2-4 years of replacement of PTR with DSR (e.g. Gathala et al. 2011).

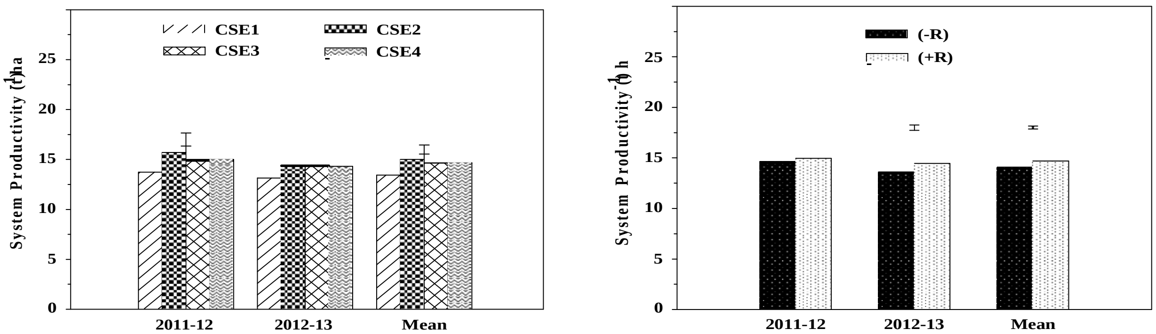

Fig.1. (A) System productivity (rice equivalent yield) of CSE, and (B) residue treatments, in the first 2 years and their means.

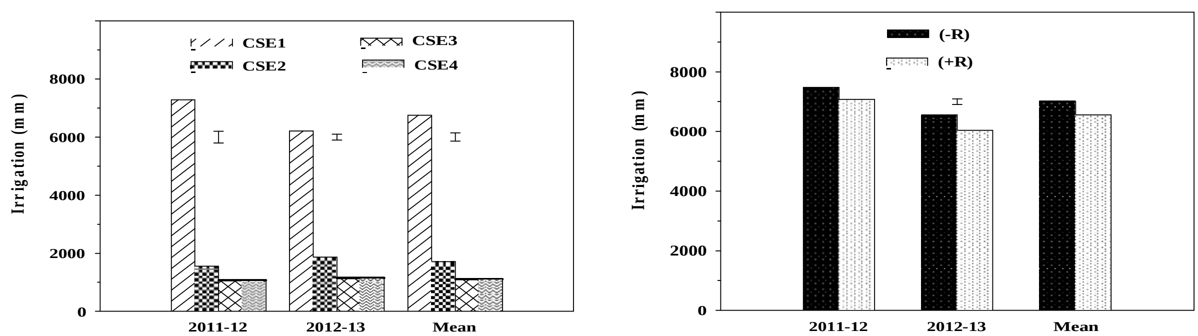

Fig. 2. (A) System irrigation input of CSE, and (B) residue treatments, in the first 2 years and their means.

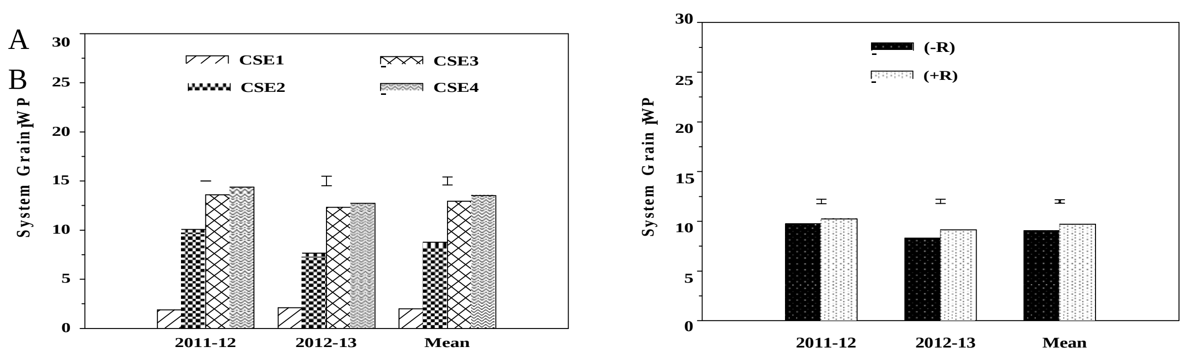

Fig. 3. (A) System irrigation water productivity of CSE, and (B) residue treatments ,in the first 2 years and their means.

Applications and Implications for Conservation Agriculture

The results suggest that replacement of puddled transplanted rice with dry seeded rice can be done with no yield loss, and with benefits for wheat grown in rotation with rice. Furthermore, tillage for all crops can be reduced to strip tillage with no adverse effects. Benefits of partial retention of aman residues began to appear in the second year. Establishment of wheat in 40 cm of standing aman residues using a PTOS was excellent with both full and strip tillage.

References

Gathala, M.K., J.K. Ladha, V. Kumar, Y.S. Saharawat, V. Kumar, P.K. Sharma, S. Sharma, and H. Pathak. 2011. Tillage and crop establishment affects sustainability of South Asian rice–wheat system. Agron. J. 103(4): 961-971.

Yadav, S., G. Gill, E. Humphreys, S.S. Kukal, and U.S. Walia. 2011. Effect of water management on dry seeded and puddled transplanted rice. Part 1: Crop performance. Field Crops Res. 120: 112–122