RESEARCH FOR DEVELOPMENT OF SUSTAINABLE FARMING TECHNIQUES FOR CASSAVA IN SON LA PROVINCE OF VIETNAM

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Introduction

Sơn La has the largest cassava production area, around 32.000 ha, in the northern mountainous region of Vietnam (NMR) with the annual total production of about 376.000 tons[3]. Before, cassava was one of the main food crops in the region, but nowadays became an important cash crop, especially for the poor-resource farmers. Although contributes just a small share to the total household income, it has significant value for living and economic development of poor farming households.

There are advantageous conditions for developing cassava industry in Son La, such as suitable climate and soil conditions, market demands and farmers traditional knowledge. Nevertheless, with changing use purpose, from foods to industry and feed processing materials, locally developed varieties are no longer appropriate. In addition, due to conventional farming practices of "slash and burn" on slopes production of cassava is now facing increasingly serious problems of soil erosion, reduced yield and low economic benefits.

In this context, under the ACIAR supported project (project AGB/078/2012), we have been implementing activities to validate and promote the adoption of some sustainable farming practices towards a sustainable inclusive value chain for cassava in Son La. The field experiments started in 2017 and was planned for 3 successive cropping seasons; Therefore to be able to have final conclusions and recommendations we need to wait for one more harvest which will be completed sometime in February 2020.

Activities and methods

The trials were conducted in 2 communes (Bo Muoi and Pung Tra) in Thuan Chau district and 2 communes (Chieng Chan and Na Ot) in Mai Son district. These sites were selected as they represent the most of cassava production conditions in the province. In each of these communes, over 70% households grow cassava, each in 0.3 – 0.9 ha of land on average, mostly on steep slopes (up to 65^{o}), and soil erosion is perceived as a serious problem.

The trials include:

- **Variety trial** evaluates 4 new varieties, Sa21-12, Rayong 9, BK and 13Sa05, using 2 locally popular ones for control, KM94, and La Tre, in order to identify new high yielding varieties that appropriate for local conditions such that farmers could have better choice.
- **Fertilizer level trial** tests 5 fertilizers treatments, in order to find the best and the most economic fertilizer rate to obtain and maintain high cassava fresh root yield and starch content but also adequate profitability.
- **Soil management trial** aims to study different intercrops and soil management techniques in order to find effective options for improving economic benefit and soil erosion control.

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[3] http://www.gso.gov.vn/default.aspx?tabid=717

- **Density trial** was designed based on the feedbacks from farmers which tests 4 planting spacing in order to find the most appropriate ones for local conditions (poor fertile soils and low-investment-capacity farmers).
- **Harvest staggering trial** evaluates performance of the 2 locally popular varieties (KM94 and La Tre) harvesting in off season. This trial was designed based on the feedbacks from Son La starch factory that they need supplies to operate until September instead of April as currently.

All the trials were farmer participatory conducted on farmers' fields. Farmers partcipicated in cassava cultivation and management activities under researchers'guidance, local extension staff's support with logistic arrangement support from local authority officers. Field days were organized at suitable times during each cropping season for all stakeholders to participatorily evaluate the treatments and provide feedbacks.

Results

- *Varieties:* When no pest impacts observed in the trials' fields, 2 out of the 4 new varieties (BK and 13Sa05) performed well and gave better yield compared to the controls. The increase in yield was between 14 % and 76%, depending on the varieties, controls and growing conditions (sites, fertilizers levels).
- *Fertilizers levels:* In general, with the same cost spent for fertilizers, using separate N, P, K fertilizers brought higher economic benefits due to higher yields of cassava compared to the mixed NPK fertilizers. When fertilized with separate fertilizers at the level of (40N, 10P, 40K) at three times (1 basal and 2 top dressing times), KM94 gave the yield of around 20 t/ha. Higher level (60N, 15P, 60K) gave the highest yield, but lower profit compared to the level (40N, 10P, 40K). Deep fertilizer placement (DFP) appeared not suitable for cassava in Son La, perhaps due to drought and steep slopes problems. Nevertheless, the impacts of fertilizers level depends also on the land conditions (slopes, fertility) and fertilizers application method (only basal application, or with 1 or 2 top dressing times). In Bo Muoi commune, for example, where the fertilizer trial was established in a flat land plot right after maize and cowpea were planted with high level of fertilizer applied 600 kg/ha of NPK for the basal and 150 kg/ha for top dressing, impact on cassava yield increase was not observed that might be the soil was still rich in nutrient elements left over from previous crop and crop residues.).
- *Soil management practices:* All 5 tested soil management practices (intercropping with mungbean, intercropping with black cowpea, intercropping with peanut, grass-contours and, dead-cassava-plant-residues-contours) did not reduce the yield of cassava. Mungbean had a very low survival rates; Shortly after germination almost mungbean individuals died. The reason might be that, the local soil and/or climate conditions are not suitable for this crop. (Local farmers also mentioned that, they have tried to grow mungbean in the area but have never succeeded). Intercropping with cowpea and peanut brought higher gross and net return thanks to additional income from the legumes. Grass-contours reduced total net income, net return per working day and also net income per 1000 vnd spent, because of increased material costs required for grass planting and management while grass did not bring any additional income; The use of grass as feeds was not efficient in our trial case, due to high labour consumption for harvesting and carrying grass long way from the field to home for cattle or fishes. Cassava-plant-residues-contours had no impacts on the cassava growth and yield, but could also prevent a significant amount of soil from being washed off away.
- *Density trial:* In the local conditions, for KM94, the density of 12,500 plants/ha (1m x 0,8 m spacing) brought highest net return and net return on a labor day. On steep slopes, normally with poor soils, among the 4 densities tested (10,000; 12,500; 15,600; 20,800 plants/ha) this density also gave the highest cassava yield. On flat lands, normally with better fertile soils, the

last three densities (12.500; 15.600; 20.800) had the same yield, but the increase in the density causes increased cost.

Conclusions

Research results obtained so far allow us to include the following points for confirmation when the last harvest has been completed in March 2020:

- Two new varieties 13Sa05 and BK are appropriate and should be promoted for large scale production in Son La
- The use of separate N, P, K fertilizers bring better economic benefits compared to mixed NPK (5-10-3) fertilizers; the level of (40N, 10P, 40K) or (60N, 15P, 60K) applied at 3 times (1 basal and 2 topdressing times) bring the highest economic benefit.
- The planting density of 12,500 plants/ha (distance of 1 m x 0.8 m) is most suitable for the local conditions (poor sloping lands and low investment capacity of farmers)
- Intercropping with cowpea or peanut increase the yield and economic benefits as well as gross income, while cassava-plant- residue contour significantly prevent soil from being washed off away and proffered by farmers for adoption.