Introducing No Till System in the Ghanaian Savannah

Background

"Ghana's project" was held during 2018, in the framework of the project called Transformation of African Savannah Initiative (TASI) at the beginning, and finally called Technologies for African Agriculture Transformation (TAAT) of the African Development Bank (AfDB), with the cooperation between the Ministry of Food and Agriculture of Ghana (MoFA) and the Argentinian No Till Farmer Association (Aapresid). Two Aapresid technicians developed soybean and maize crops in four plots working closely with technicians from MoFA and local farmers. Also, two Argentinian machinery companies supported the project with a planter and a sprayer.

The Aapresid´s vision is guided by the objective to promote sustainable production systems of food, fibre and energy through innovation, science and network knowledge management. This approach refers to the responsible and efficient use of the limited world's natural resources to maintain the demands of their growing population.

First step

During the initial phase, Aapresid designed agronomic protocols and implemented productive activities with the aim to adapt conservation agriculture technology packages for soybeans and maize production in Ghana.

In order to achieve this target, the strategy was based in adjusting activities and processes related to a no till tropical agriculture benchmark model, using the available technologies. It was key to understand how the current level of mechanization, inputs and agronomic skills could impact the productivity of the proposed system.

We had to select the fields where the implementations were going to be held and then we had to look for information of climate (temperatures minimum, maximum and average, quantity and distribution of the rains, etc); soils, physiography and all extra data that could help us to characterize the agro ecological condition.

The original idea was to work in four different places, with 50 hectares in each one and half of this area with soybean and the other half with maize. The problem was that we could not find the fields in good conditions (without trees, roots, steaks, etc) and we could plant only 32 hectares of maize and 62 of soybean in total.

The places where we worked were Kukobila, Sang, Jimlé and Guo; all of them nearby Tamale, in the northern region.

The main characteristics of the region are the following:

- Selected plots were located under the tropical climate. The area shows an altitude between 100 and 200 meters above sea level, with minor slopes with an inclination between 0.5% y 3%.
- The average of annual precipitation fluctuates between 700 and 1200 mm, taking from April/May and October/September, allowing to identify two clear seasons in a year: a rainy season and a dry season.
- With regards to the observed temperatures, the region follows the parameters related to the Tropical Savannah Climate. The average temperature is 28°C with a minimum record in the dry season, when the Harmattan (hot and dry wind coming from the Sahara desert), takes place.
- The type of vegetation varies between zones, with predominance of tallgrass with shrub and isolated trees like Baobabs, Acacias, and Shea nut Tree.

The map shows the location of Tamale, in the Northern Region.

The "Why" of the strategy

After we had the plots and their agroecological characterization and before to plant, the second step was to implement the Good Agricultural Practices (GAPs) in which the process was going to be based on. The GAPs are at the center of the agronomic protocols designed for the adaptation exercise in Ghana. The GAPs selected for the approach reflects the GAPs

main pillars: No Till, Crop rotation, Nutrition Management and Balanced Fertilization, Integrated weeds, insects and diseases management and Safety use of phytosanitary products. Information coming from testing the technology will come from estimation and control of the sowing density, the evaluation of local germplasm, the elaboration of an equilibrated fertilization plan and a test for several planting dates. The protocol is structured in a working plan with activities for the entire productive cycle: measuring and leveling productive land; weed control protocol; sowing tasks; diseases, weeds and insects control activities, and harvest.

All the GAPs are very important. The No till is just a tool that consists in the implantation of the crops without the previous or subsequent use of tillage, through the use of sowing equipment that must have the capacity to cut the surface cover of the soil, open a small sowing line, deposit the seed inside and close the open groove with special wheels.

Then, the weed control is performed by adjusting rotations and chemical intervention at specific times. In turn, given that there is no tillage of soils, and therefore there are no violent pulses of mineralization, the fertilization strategy must necessarily change and adapt to the new edaphic conditions.

Another important characteristic is the permanent presence of coverage over the soil. Something that in appearance seems so simple, is only reached if the non-tillage condition is supported by other GAPs such as crop rotation with an adjusted diversity and intensity, and a nutritional management - via nutrient replenishment - that allows to maintain the productivity time of the soils.

The following photo is from Argentina and shows how the surface of the fields stay after planting the new crop.

The presence of cover decreases water losses through direct evaporation, and protects the soil structure from the impact of raindrops. Everything results in more water available for crops and less losses; in short, a more efficient use of the generally scarce resource: water. Faced with plentiful, copious and large rainfall phenomena accumulated in a short time, No

Till well done is a tool that helps mitigate the negative effects of the runoff.

Working at the fields

The first year of the intervention (Season 2018), Aapresid protocols proposed to test several germplasms of maize and soybeans in different planting dates. However, logistics delays regarding the arrival of the no till planting machine partially affected the testing program. In particular, the planting window have been reduced (planting dates) and density tests were not able to implement, since the conventional planting machines used to support the exercise were not able to calibrate discs at different rows length.

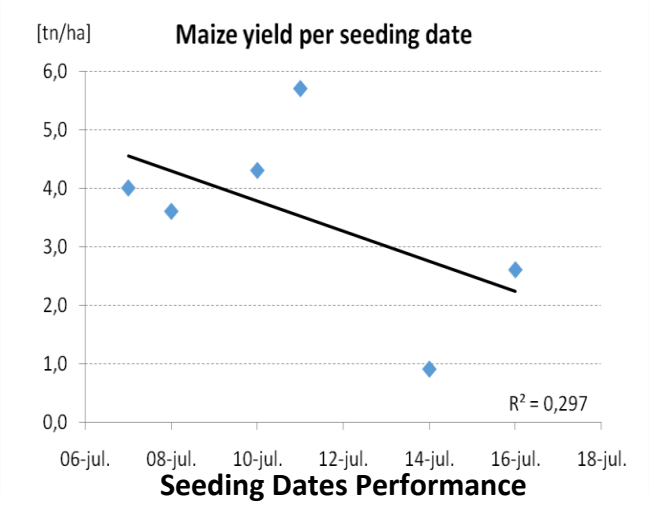
In soybean, two varieties have been tested in four different plots. In the first year, average yield for Janguma y Afayak varieties was 1.9 TN/HA and 1.7 TN/HA respectively. Even if Janguma provided better results, Afayak showed good response to some ambient. Both varieties should be repeated during the next season.

The photo shows a crop view of soybean at Kukobila farm.

Regarding maize crops, two different hybrids of yellow maize have been tested: Pioneer Adinkafo 30Y87 y Pannar Pan12 with an average yield of 3.4 TN/ HA and 3.6 TN/HA respectively. Pionner showed a lower performance, however its yield was less volatile that Pannar. Both options should be tested again in the next cycle.

Correlation between sowing dates and yields showed a better adjustment in the maize test. In this regard, is possible to say that the dates selected to begin sowing could explain the yields better. Like soybeans, maize production revealed a negative trend in lagging the plating window, estimated in 250 kg per day. These results may be related to the concentration of this crop. Extend the sowing window is recommended for future tests to explore other ecological environments.

This following graphic explain what was mentioned before:



Regarding **weed management**, in general terms, they have been controlled easily with low doses of herbicides. Therefore, the weed control program and related activities have been successfully implemented. However, is important to mention the following considerations.

- Due to the use of non-GMO technology**, the production required more expensive herbicides** in higher doses than GMO germoplasm.
- Due to the **low presence of green coverture** at plot´s surface, either because fire or recently tillage practices, the land has been more exposed to sunlight, creating conditions for strong weed germination.
- **Inefficient plot division**. The absence of fences and clear divisions between plots created additional problem during land preparation tasks, in particular regarding herbicide application. Without a clear plot differentiation, spreader operators had difficulties to apply the right recipes prepared for each crop facilitating uneven grades of phytotoxicity.

Skill transfer program

All technology transfer process must include training, whether workshops, lectures and/or field visits to facilitate the learning process and to generate ownership among farmers on the new technology. In this sense, Aapresid planned to carry out a series of workshops, some theoretical and practical for technicians, farmers and operators of agricultural machinery.

Three workshops were carried out during 2018 supporting the technology adoption process. They covered no-till relevant topics for Tamale region:

- General introduction to no-till systems.
- Sprayer adjustment.
- Fall army worm management.

Each workshop was attended by between 15 and 25 people, including farmers, technical

managers, machine operators and enthusiastic young people.

The previous picture was taken during the workshop of “Identification and Control of Army Worm”.

Final considerations

The introduction and adaptation of No Till System (NTS), is a process that last at least 4 or 5 years to be establish properly. We always say that we cannot “copy and paste” because we work with alive organisms like seeds and plants and the interaction between them and the environment is specific for each region.

After the 5 first years, new challenges and problems will appear. It is normal and it happen everywhere when the system become complex, but with knowledge development locally with farmers, scientists and technicians working together the solutions will come.

Meanwhile, in this moment and after the first season in the Northern Region we can say that **the agro ecological conditions presents good potential for maize and soybean production** thinking in the commercial terms.

From Aapresid, we think that is important to work harshly in capacitation and training for technicians, students and farmers. Also, the government should think how to promote the settlement of agriculture machinery companies which can provide good technical service and spare parts supply. If the region had a market of inputs, seeds, machinery, agronomists, etc, the success of the project would be assured.

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