STAKEHOLDER BRIEF

ACIAR Cassava Value Chain and Livelihood Program

Fertilizer use in the Cassava Sector in Indonesia

Summary

Indonesia is one the largest producer of fresh cassava roots in the world. However, Indonesia is also the world's second biggest importer of cassava starch. This highlights that Indonesian cassava production is still not able to meet the needs of domestic cassava starch factories. One of the reasons for this is the relatively low level of cassava productivity in Indonesia, which in turn is associated with the fact that most cassava in Indonesia is planted in marginal/sub-optimal land that has low fertility levels.

Field trials carried out in Simalungun district of North Sumatra Province and Sikka district of East Nusa Tenggara Province under the project AGB/2012/078 between 2015 and 2020 show farmers in Simalungun district already applied the appropriate fertiliser for the cassava, however there are many difficulties related to availability of fertiliser. In contrast, farmers in Sikka district never applied fertiliser to cassava, but used fertilizer for maize (the main crop in the area). Field trials it showed that effective application of inorganic fertilisers in cassava production by smallholder farmers could substantially increase yield. The main challenges to adoption are (i) low availability of inorganic fertiliser in Simalungun district; and (ii) the reluctance of farmers in Sikka to buy non-subsidised fertilisers.

Key policy recommendations are establishing the linkage between private fertiliser companies and the starch factory to increase the availability of fertiliser to the farmers in Simalungun district. In the Sikka district, the availability of subsidised fertiliser is prioritized for maize rather than for cassava, thus there is a need to coordinate with the field extension officer to allow the allocation of non-subsided fertiliser for cassava after harvesting maize.

Background

Indonesia is the third largest producer of cassava production in the world, however Indonesia is also the largest importer of cassava starch. One of the reasons for this that cassava productivity in Indonesia is still relatively low and production of fresh cassava roots cannot meet the demand from local starch factories. The majority of cassava production is in South and North Sumatra Province, while the area with potential for expansion of cassava production is in the eastern part of Indonesia.

In Simalungun district (North Sumatra) farmers already apply fertilizer to their farm every year but in relatively small quantities. Fertilisers are difficult to obtain as they are prioritised for other crops including rice and oil palm. On the other hand, in Sikka district (East Nusa Tenggara Timur) farmers only apply a small amount of fertilizer for maize, but not for cassava. This relatively low level of fertiliser use may contribute to the low productivity of cassava in Indonesia. Most of the farmers in both districts have an appropriate knowledge about fertilizer, however farmers still don't know the optimum dosage of fertilizer and the appropriate timing to apply the fertilizer.

Key Issues

Different Adoption Rates: A household survey done in 2017 in Simalungun and Sikka showed that most of the farmers use fertiliser, but with different characteristics between the two districts. Fertiliser adoption rates were around 94 percent in Simalungun where cassava farming is practiced as a monoculture, and 50 percent in Sikka in the maize intercrop with cassava. The rate of inorganic fertiliser adoption is higher in Simalungun compare to Sikka.

Inappropriate quantities applied: Farmers in both locations are aware of the benefit in applying fertiliser for their farm, as indicated with higher adoption rate. However, the rate of fertiliser application is varied, and is affected by the availability of fertiliser in both locations. On average, farmers in Simalungun applied around 50 kilograms of urea; 50 kilograms of super phosphate and 50 kilograms of potassium fertiliser per hectare per year to their cassava fields.

The amount applied in Sikka was lower than in Simalungun. Farmers in Sikka mainly applied fertiliser in a form of NPK fertiliser (11:11:11) with average rate of 100 kg per hectare per planting season for maize. Farmers in Sikka plant maize as the main crop, and cassava as the second crop, and there is no fertiliser applied for the cassava once the maize has been harvested.

Timing of application: In Simalungun, farmers apply the fertiliser during planting and three weeks after planting. During planting, the most common type of fertiliser used is Urea, which is applied by almost 60% of farmers. NPK is the most common fertiliser for the first application after planting, with almost 36% of farmers applying at that time while a further 12% also applied in a second round.

In Sikka, fertiliser was applied only during the planting of maize in the early rainy season (December/January). During planting, the most common type of fertiliser used is NPK, which is applied by over 60% of farmers. After the maize is harvested, farmers do not apply fertiliser for cassava.

Not optimal fertiliser formulations: In Simalungun, the most common fertiliser used by farmers is Urea, followed by superphosphate, and NPK (11:11:11). Only around 32 percent of farmers knew what the fertiliser formulation that they utilised was. Fertiliser availability is also a concern in Simalungun, where cassava farmers are competing with palm oil farmers to buy fertiliser.

The most common fertiliser available and used by farmers in Sikka is NPK (11:11:11), a formulation which is also not optimal for cassava production. In addition, there almost 80 percent of surveyed farmers did not know what the fertiliser formulation that they utilised was.

Awareness of NPK meaning not high: In many cases farmers are not even able to identify what the meaning of NPK formulations are. Almost 60 percent of surveyed farmers in Simalugun and 80 percent in Sikka admitted to not understanding what the NPK values written on the side of fertiliser bags stand for.

The cumulative effect of these issues is that although most of the farmers applied fertiliser to their field, the effectiveness of fertiliser in boosting soil fertility and maintaining or increasing yields is relatively limited.

Key relevant findings from research

Agronomic results and economic analysis undertaken in both Simalungun and Sikka between 2017 and 2020 have consistently shown that timely applications of correct formulations of fertiliser result in increased fresh root yields and can deliver positive economic results to farmers.

Agronomic Results

In **Simalungun**, 3 combination of single fertiliser (i.e Urea + Superphosphate + Potassium Chloride) were compared with farmers' practice (i.e.45kg N + 45kg P_2O_5 + 25kg K_2O kg per hectare). The trials were conducted in farmer's fields and in trial fields, with planting density of 12,500 Plants per hectare. In addition, farmers were also interested in applying organic fertiliser (10 tons per hectare of manure) to compare with the inorganic fertiliser.

Fresh root yield ranges from 29.6 (control) to 37.9 (optimum fertilization rate) tons per hectare across all treatments and locations. Fresh root yield from the farmer's practice was lower compared to the other treatments. An improvement on fertiliser application rate (45kg N + 45kg P_2O_5 + 155kg K_2O kg per hectare) could give an additional yield of 8 tons per hectare. The maximum yield of 37.9 tons per hectare was achieved when the rate of K_2O was increased to 115 kg K_2O per hectare. The yields per hectare from application of manure showed no difference from the existing farmer's practice, and due to the high cost of manure, farmers were reluctant to continue applied manure to their field.

In **Sikka**, the main constraints to fertiliser application were lower planting density (hence ineffective fertilisation) and farmers only applying fertiliser once during maize planting. Farmers are reluctant to plant cassava in at higher density due to concerns it will reduce the maize yield. Trials in 2017-2018 combined the type of fertiliser application (single fertiliser Urea + Superphosphate + Potassium Chloride) with variations in planting space (1 x 1m and 2 x 1m). Results showed that there was no significant difference ($P>0.05$) in the maize yield related to higher density of cassava planting. Results also showed that combining Urea + Superphosphate + Potassium Chloride (300; 100; 100 kg per hectare) increased the fresh tuber yield up to 5 – 7 tons per hectare compared to the single Urea application practiced by farmers.

Economic Analysis

In **Simalungun**, the farmer's current practice of fertilising their fields cost approximately IDR 1,100,00 for Urea + Superphosphate + Potassium Chloride fertiliser per hectare per planting season. The return from the fresh tuber yield (29 tons per hectare) is around IDR 35,000,000 per hectare. With the recommendation fertiliser from the trial (45kg N + 45kg P_2O_5 + 155kg K_2O kg per hectare), income increases by IDR 10,000,000 per hectare, with additional cost of IDR 800,000 for the Potassium Chloride fertiliser.

In **Sikka**, the farmer's current practice only applied fertiliser at the planting of maize with cost varying between IDR 700,000 (monoculture cassava) and IDR 1,100,000 (intercropping with maize) per hectare. The net return

of fresh tuber yield from the current practices were around IDR 14,000,000 per hectare (monoculture wide planting space 2 x 1) to 21,000,000 (intercrop with maize). If farmers adopt the fertiliser recommendation from the trial (300kg Urea + 100kg Superphosphate + 100kg Potassium Chloride kg per hectare), it is expected that farmers will get an increase in income of around IDR 17,000,000 (monoculture wide planting space 2 x 1) to 30,000,000 (intercrop with maize) per hectare, while costs will increase by IDR 1,000,000.

Recommendations based on research findings

Fertiliser companies should engage the farmers and industry: One of the key investments in facilitation of the effective use of inorganic fertiliser for cassava production will be for fertiliser companies to develop appropriate formulations for cassava. The project can make trial results from 2017 to 2020 available to assist farmers in choosing the correct fertiliser type and also timing of application. Furthermore, based on the trial and farmers engagement, there is a possibility for collaboration between fertiliser company, government and industry to ensure the availability of appropriately formulated fertiliser to the farmers.

The agricultural extension agents, factory agents and local government should develop and extend communication materials related to the availability, correct usage rates and timing of application of subsidised and non-subsidised fertilisers: Agronomic results from the project have clearly shown that application of inorganic fertilisers can increase fresh root yield and have a positive impact on economic returns for smallholders. However, it can be seen from survey results that there are farmers that still don't understand what fertiliser is appropriate and when should they apply the fertiliser. Hence, the agricultural field extension officers and factory agent should reach and engage to the farmers. Moreover, there is a need for communication and collaboration between agricultural field extension officers, farmers group and fertiliser companies to manage the fertiliser plan for farmers in order to increase the availability of subsidised fertiliser. In the case of Simalungun, starch factories and fertiliser companies could cooperate in order to establish a loan program for non-subsidised fertilisers to the farmer.

This stakeholder brief summarises issues, findings and key policy recommendations related to fertiliser use in the cassava sector in Indonesia from ACIAR Project AGB/2012/*078 Developing value-chain linkages to enhance the adoption of profitable and sustainable cassava production systems in Vietnam and Indonesia.* The project is funded by ACIAR and implemented by ILETRI, University of Brawijaya, CIAT and the University of Queensland. The intended audience of this brief is the Ministry of Agriculture, Ministry of Rural Development, Local Government and extension centres in Simalungun and Sikka and the private sector stakeholders in the cassava value chains in the two provinces.

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