# Phosphate fertilisation in potato

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## Fertilisation with phosphate in potato cultivation

Potato farming in Indonesia uses a great deal of phosphate ($P_2O_5$). Data from potato farmers showed total $P_2O_5$ inputs of almost 581 kg/ha: 249 kg/ha applied directly in the form of chemical fertilisers and 322 kg/ha originating in 22 tonnes of manure/ha. The chemical $P_2O_5$ is applied mostly as a component in NPK fertilisers, often on top of an application of super phosphate (SP). The costs associated with the application of 247 kg $P_2O_5$ were almost 13 million Indonesian rupiah, while 25 tonnes of manure cost 10 million rupiah. This represents a considerable expense for farmers (around 20% of production costs) and is potentially quite harmful for the environment.

## Trials with fertilisation using phosphate

Phosphate fertiliser trials in the dry season of 2015 identified options to reduce $P_2O_5$ inputs in Garut Regency and the district of Pangalengan. These demonstrations in both Garut and Pangalengan showed farmers the effects of using different amounts of chemical fertilisers and manure. Farmers were frequently invited to observe the fields and share opinions on the performance of Atlantic and Granola potato varieties.

## Results

In the $P_2O_5$ trials in Garut, each hectare yielded approximately 34 tonnes when 10 tonnes of manure were applied together with 125 kg $P_2O_5$ in chemical fertilisers. In Pangalengan, yields remained at 22 tonnes per hectare when more than 165 kg $P_2O_5$ were applied with 10 tonnes of manure. The effectiveness of fertilisation with phosphate depends on existing phosphate in the soil, which had been found in the trials to be sufficient. These results indicate that reductions in $P_2O_5$ and manure input without compromising potato yields may well be possible if there is sufficient phosphate in the soil. Reducing $P_2O_5$ inputs also reduces costs for fertiliser, manure, and labour, and improves the resource use efficiency of inputs. Farmers, however, are not aware of the phosphate content in their soils, nor of nutrients applied with manure, and they have no knowledge about the nutrient content of products used.

### *Highlights*

- *Farmers in Indonesia use approximately 22 tonnes of manure per hectare in potato cultivation, which corresponds to around 322 kg of phosphate per hectare.*
- *On average, farmers supplement 249 kg of phosphate per hectare in addition to that applied through manure.*
- *Demonstration trials showed that manure applications can be reduced by 10 to 15 tonnes/hectare without reducing yields.*
- *Demonstration trials showed that a reduction of chemical $P_2O_5$ inputs to 165 kg/hectare does not decrease yields.*
- *The existing phosphate content in the soil should be taken into account for an adequate $P_2O_5$ advice.*

## Final results

A reduction of 10 tonnes/hectare of manure saves farmers around three million rupiah per hectare in product costs. Less manure also means lower transport and labour costs. Savings related to reduced chemical $P_2O_5$ inputs are smaller: 80 kg less $P_2O_5$ per hectare (a reduction from 24900000 to 165 kg/ha of SP) saves farmers around 0.5 million rupiah on product costs. When NPK fertilisers are reduced by 80 kg $P_2O_5$ per hectare, savings increase up to 1.7 million rupiah per hectare. To make the most of these findings, however, a reliable $P_2O_5$ advice system which takes into account existing phosphate in the soil needs to be developed first.

## Options for improvement

- The $P_2O_5$ content in manure is unknown to farmers. Awareness of $P_2O_5$ content will enable farmers to better adapt $P_2O_5$ inputs to crop demand.
- While most $P_2O_5$ fertiliser advice systems take into account phosphate content in the soil, no such system currently exists for potatoes in Indonesia. As $P_2O_5$ fertiliser prices are likely to increase in the future, and fertiliser subsidies from the government may decrease, an adequate advice system should be developed in time.
- Most farmers apply phosphate in combination with nitrogen and potassium, and crop demand for each nutrient can be different. Using single-nutrient products allows for an improved use of resources.

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