

## Submission by Indonesia

### **Adaptation Measures in Indonesian Agriculture for Coping with the Climate Change**

[Workshop on the identification of adaptation measures, taking into account the diversity of the agricultural systems, indigenous knowledge systems and the differences in scale as well as possible co-benefits and sharing experiences in research and development and on the ground activities, including socioeconomic, environmental and gender aspects](#)

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Indonesian Agriculture is very diverse in terms of crop types, soil fertility, rainfall amount and distribution, topography, farmers' socio economic backgrounds, availability and distribution of agricultural inputs, and infrastructure. All farming systems are affected, but annual-crop-based farming systems, managed by resource poor farmers are the most vulnerable to climate change.

Among the main threats of the changing climate are irregularities, and hence, the difficulties in the forecast of the onset of the rainy season. This causes difficulty for the farmers in determining the planting time, especially in rainfed areas. Indonesia has also observed the increased frequency of extreme weather; high and torrential rainfall, shortened wet spell and longer dry spell in some areas. The El Niño events tend to increase in its frequency to every 2 to 5 years in the last two decades, an increase from every 5-7 years in and prior to the 1990s. El Niño causes droughts and increases fire risks that affects vast areas of Indonesia. The increase in air temperature has been and will potentially be affecting crop growth and production in a more serious manner, calling for enhanced research for developing hardy high yielding varieties. In addition, the low lying areas of rice baskets in the northern coast of Java island are the subscribers of salt intrusion. This problem will be affecting larger areas as the sea level continues to rise.

Studies also show that relying on single crop such as rice as a source of staple food, positions food security at risk. Rice is very sensitive to increase air temperature. Rice yield is projected to decrease by 10% if the average air temperature increases by 1 °C. Therefore, diversification of carbohydrate sources is a must in the long run. Crop diversification is also important to reduce the risks of pests and diseases infestation as well as unfavorable climate conditions.

To address the more and more serious problems of the changing climate, increased ability in weather forecast will be indispensable.

Improved techniques of soil and water management will be necessary and development of salt, flood and drought tolerant varieties need to be enhanced. Selection of suitable crops for different agro-ecological (climate and soil) zones, coupled with developing of adaptive varieties, especially of annual crops will be needed.

Management techniques have been tailored to suit climate and soil conditions and to increase farming systems' resilience to extreme climate conditions. These include:

- recycling of organic matter,
- soil and water management and conservation (<http://ejurnal.litbang.pertanian.go.id/index.php/jppp/article/view/3094>),
- balanced fertilization,
- irrigation and drainage,
- water use efficiency,
- water harvesting, and
- use of suitable crops and adaptive varieties.

In most instances single innovation is less effective. Technology innovations, therefore, are disseminated in packages of technology components. These include:

- Crop-livestock integrated systems
- Multiple cropping including relay planting and intercropping
- Agroforestry systems

A package of technology components for paddy rice intensification is delivered in the scheme known as "Seven management pillars", which consists of; application of quality planting materials; proper soil tillage system; balanced fertilization; integrated pests and diseases control; irrigation and water management; post-harvest management; and marketing.

Tools and products have been developed to support farmers. These including integrated cropping calendar (<http://katam.litbang.pertanian.go.id/> *In Indonesian language*) and soil and fertilizer test kits (<http://balittanah.litbang.pertanian.go.id/ind/index.php/en/inovasi-teknologi/282-puts-perangkat-uji-tanah-sawah> *In Indonesian language*). The cropping calendar provides recommendation to farmers on the best planting time. It also recommends the needs for fertilizers and other farm inputs required in sub-district level as well as raises awareness on potential threats of pests and diseases infestation. Soil and fertilizer test kits for devolving fertilizer recommendation and fertilizer quality testing to extension workers and farmers' groups have also developed.

Those management techniques can lessen the danger, but they can't fully eliminate the loss suffered by farmers during the extreme climate events. Therefore, the government has implemented Agricultural Insurance program in 2015, starting in one million ha area of paddy rice area.

Despite those innovations, agriculture is still vulnerable and the degree of vulnerability will increase with the increasing degree of climate change. The challenges are:

- How to improve the accuracy of weather forecast to minimize uncertainty
- How to improve the infrastructure to cope with extreme climate events
- How to increase awareness among government institutions and communities on the danger of extreme climate and hence enhance preparedness at the national and sub-national levels
- How to deliver the information, especially to farmers in the remote areas
- How to improve extension workers' and farmers' capacity
- How to distribute agricultural inputs to remote places
- How to improve farmers' adoption of adaptive technologies

We believe that the problems and challenges as elaborated in this submission is not unique for Indonesia only, but also applicable to other countries, especially in the tropics. The problems are so high to be addressed in isolation by each country. Collaborative efforts among countries, under the umbrella of UNFCCC, will be the way forward. Therefore, we recommend joint efforts in the following aspects:

- Technology and information transfers
- Collaborative research, especially on weather forecast, development of adaptive crop varieties, and on adaptive measures for various types of farming systems
- Extension systems for reaching the vulnerable farmers and vulnerable areas
- Capacity building for researchers, extension workers, and farmers
- Enhancement of means of implementation