

Alternative upland farming system under different climate scenarios

Linda M. Peñalba*¹, Felino P. Lansigan², Dulce D. Elazegui¹, Francis John F. Faderogao¹

¹ College of Public Affairs and Development, University of the Philippines, Los Baños

² College of Arts and Sciences, University of the Philippines, Los Baños

***Corresponding author:** Impenalba@gmail.com

The Philippine uplands contribute significantly to food production. About 5 million hectares is under cultivation, but much of it has been degraded, and about 70% has soil erosion problems (Cruz et al. 2010).

Intensification of upland cultivation is expected because of high population pressure and conversion of lowland areas due to urban expansion. This is expected to exacerbate upland degradation, since conservation agriculture (CA) is not yet widely practised, and weather events are expected to intensify.

Currently, upland farmers practise row cropping and ploughing along the slopes. No-tillage or zero tillage is not a popular practice in the uplands, and farmers are not convinced that high productivity is possible without tillage. Farmers till to place the seeds into the soil, to control weeds on the large scale, to promote aeration of the soil, and to promote the mineralisation and release of nutrients from soil organic matter.

Typhoons are the most destructive weather events experienced by Philippine farmers. When they arrive in May, at the end of the dry season, they cause severe erosion, because the soil is exposed and powdery. If current practices are not modified, the combined effect of temperature increase and rainfall increase will worsen soil erosion. These events already cause massive soil erosion and degradation, which result in low farm productivity. For example, more than 350 large dams have become silted, reducing irrigation efficiency and loss of 20% to 30% of irrigated lands (Cruz et al. 2010).

Climate change scenarios are useful in characterising future climate risks and for evaluating the performance of adaptation options, but most scenarios operate at the national or greater scale. These projected climate scenarios have to be downscaled to determine more precisely the appropriate local response actions. Such downscaled projections can be used by planners in designing innovative CA technologies for the Philippine uplands and in planning R&D to improve the current upland farming practices and climate change adaptation in the country.

We present projected climate change scenarios in selected Philippine uplands in 2020, 2050 and 2080; their potential impacts on rice yield if current practices continue; and recommended alternatives to achieve food security and sustainability.

The results can be used by local planners in preparing local plans to mitigate social, economic and environmental impacts of climate variability and extremes on a specific sector.

In a SUMERNET- and CDKN-funded project on climate change, food security and livelihoods of small-scale farmers, we collected data on rice yields and production practices in the Philippine provinces of Tarlac and Pangasinan through key informant interviews, focus group discussions and interviews with rice farmers.

Daily rainfall and temperature data from 1971 to 2000 were collected from the national weather bureau. A statistical downscaling technique using the Coupled Global Climate Model (CGCM3) was used to generate climate scenarios in 2020, 2050 and 2080.

The potential impacts on rice yields were determined by using the Decision Support System for Agrotechnology Transfer crop simulation model, which integrated generated daily weather data with physiochemical properties of soil, rice crop management practices and genetic coefficients of standard rice cultivars to simulate the growth and development of the crop. There will be not much difference in rainfall patterns between the baseline, 2020, 2050 and 2080 scenarios (Table 1).

However, the amount of rainfall is expected to increase considerably from 300 mm to 400 mm in June, from 500 mm to 800 mm in July, and from 300 mm to 400 mm in September. These changes in rainfall distribution might have serious effects on rice yield, since these months coincide with critical periods in the rice production cycle.

Table 1. Projected climate scenarios for Tarlac and Pangasinan provinces.

Year	Temperature (°C)		Rainfall (mm)	
	Tarlac	Pangasinan	Tarlac	Pangasinan
Baseline	27.15*	27.85*	158.82	199.31
Percentage change				
2020	-0.95	0.0044	75.64	25.38
2050	2.59	0.0475	80.28	27.45
2080	2.59	0.0048	80.58	27.71

*Average temperature.

The combined effects of the increases in temperature and rainfall on rice production vary with the time period, location, cropping season and planting schedule. In general, yield will increase in both provinces (Table 2).

Table 2. Effect of projected climate scenarios on upland rice yields.

Year	Tarlac	Pangasinan
Baseline*	5387.81	6963.6
Percentage change		
2020	15.9	5.36
2050	48.4	7.53
2080	-34.95	6.2

*Actual yields based on interviews with rice farmers.

To take advantage of the expected changes in water supply during critical plant growth periods, we recommend:

- adjustment of the cropping calendar to avoid water stress during the critical months
- crop rotation and diversification to control pests and diseases
- construction of small reservoirs and bunds to capture rainwater for use during the dry months
- zero-tillage for more effective water infiltration and to prevent soil erosion and degradation
- use of appropriate cultivars such as drought-resistant or submergence-tolerant ones
- farmers' education to improve the social acceptability of CA technologies and to help farmers make informed decisions on technologies they can adopt in consideration of the projected climate changes.

Further research should estimate soil losses that projected climate change may cause, study what characteristics of rice crop should be further developed to adapt to projected climate conditions, and study the social, economic and environmental impacts of various CA technologies and the social acceptability of innovative farming practices.

Keywords

Downscaled climate scenario, Philippines, Tarlac, Pangasinan

References

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