AN APPLICATION OF CLIMATE CHANGE SCENARIOS IN STUDYING THE EFFECT OF CLIMATE CHANGE ON CROP WATER REQUIREMENT AND WATER BALANCE IN A RESERVOIR:

A CASE STUDY OF THE PLANNED NAM NGA GNAI RESERVOIR PROJECT, SANAKHAM DISTRICT, VIENTIANE PROVINCE, LAO PDR

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ABSTRACT

Climate change is an issue currently being faced by the global community. Climate change will have significant effects on the management of water resources and irrigated agriculture. Irrigated agriculture is sensitive to climate change. This study was conducted under simulated climate conditions (SCCs) at 3 different levels of atmospheric CO_2. Under these conditions the study aimed 1) to study the present and future availability and utilization of water in the dry-season cropping of the planned Nam Nga Gnai (NNG) project; 2) to compare the water balance, the cropping area and the profit among cropping patterns; and 3) to explore the appropriate cropping patterns.

Results showed that the water supply may increase over the dry-season (October to April), while evapotranspiration of crops showed no clear trend. Some of the current planned cropping patterns in the NNG project plan were not viable for the present and future situation. Under the baseline conditions and for the project area, there was a water shortage in the dry-season for rice with fish ponds pattern and for the combination crop pattern (maize, green bean, lettuce, cabbage, tomato, cucumber and fish pond). Under SCCs of CO_2=540 ppm, also there were water shortages for the rice with fish ponds pattern. On the other hand, the increase in water supply during the dry-season enables farmers to increase the irrigated area for the crop combination pattern which is more than the baseline condition (CO_2=360 ppm) by 11% under SCCs at the level of atmospheric CO_2 =540 ppm and by 12% at CO_2=720 ppm.

The increase in water supply under SCCs at the levels of atmospheric CO_2=540 ppm and 720 ppm can generate 67% and 84% more profit respectively than the baseline for the rice with fish ponds pattern and for the combination crop pattern. The profit increased to 24% at CO_2=540 ppm and to 30% at CO_2=720 ppm. Future water supply generated higher profit for single cropping pattern of maize, green bean, cabbage, lettuce, tomato and cucumber, than the baseline. The profit ranged from 77-93% under SCCs at the level of atmospheric CO_2=540 ppm and 89-100% under atmospheric CO_2=720 ppm for each cropping pattern.

Under SCCs at 3 different levels of atmospheric CO_2, the cropping patterns studied could be ranked in terms of farming profit generated. The study ranked the cropping patterns from the highest to least based on the results: cucumber, tomato, cabbage, lettuce, a combination of crops, rice with fish pond, maize and green bean. However, discussion with the Lao PDR authorities revealed that the combination crop pattern and the rice with fish pond were more preferred due to the influence of existing cropping patterns and consumption demand than the single cropping patterns in spite of the high profit generated by the single patterns. However, in the situation of single cropping patterns, it is recommended that the farmers use the pattern yielding the highest profits as found from this study.

KEY WORDS: THE PROPOSED NAM NGA GNAI PROJECT / CLIMATE CHANGE/ WATER BALANCE IN RESERVOIR / PROFITABILITY/DRY-SEASON CROPPING PATTERNS / SIMULATED CLIMATE CONDITIONS OF ATMOSPHERIC CO_2 LEVELS

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