ABSTRACT

UMI HARYATI, Improvement Water Use Efficiency for Sustainable Upland Agriculture through Various Irrigation Techniques on Typic Kanhaptudult Lampung. Under the supervision of: NAIK SINUKABAN, KUKUH MURTIKLASONO, and ABDURACHMAN ADIMIHARDJA.

Inadequate irrigation water is the main factor causing low productivity of the upland agriculture in Indonesia. Water supplement through various methods of irrigation practices gave significant increase to almost all of crop productivity. On the other hand, the water use efficiency (WUE) under the conventional flooding system, is generally low. This research was aimed to: 1) determine the management allowable depletion (MAD) level for irrigation scheduling for optimizing WUE, 2) study the effects of alternative irrigation techniques on the WUE, 3) study the effects of rice straw mulching on the WUE, 4) evaluate the economic feasibility and optimum farm scale of the various irrigation techniques.

The research was carried out at Tamanbogo Experimental Station, Lampung, which consisted of two field experiments. The first was determination of MAD level for irrigation scheduling of chili cultivation. This field experiment was arranged in split plot design with three replications. The main plot was irrigation water source consisted of ground water and surface water and the sub-plot was MAD level consisted of 5 level (20, 40, 60, 80 and 100 % of available water). The second was the application of four irrigation techniques and three levels of raw mulching for chili cultivation. This field experiment was also arranged in split plot design with three replications. The main plot was irrigation techniques modified conventional practice, drip, sprinkle, sub-surface) and the sub-plot was raw mulching consisted of three levels (0, 5 and 10 tones/ha). The results of the field experiment showed that the quality of surface water was better than the ground water, leading to a higher WUE level. The best MAD level was at 60% of available water; the amount of irrigation water needed at this MAD level was 9.6 m3, and the frequency of irrigation was once in every 3 days. This MAD level reduced total water use as much as 264 mm/planting season without reducing chili yield. Sub-surface irrigation was the most efficient technique; it gave the highest WUE (0, 78 kg chili yield/m3 irrigation water). Straw mulch on each irrigation techniques increased crop yield and WUE, except for the sub-surface irrigation. All of the irrigation techniques were economically feasible because they reached the benefit cost ratio (BCR) > 1, net present value (NPV) > 0 and internal rate of return (IRR) > current interest rate (IRR > 17 %). The modified conventional practice and sub-surface irrigation techniques gave the highest benefit cost ratio (BCR = 3.40 and 2.65 respectively) and the minimum farm scale that meet worth life living standard around 0.80 ha. The drip irrigation technique practiced by farmer gave the highest NPV (18.3 million piahs/ha/year) and the lowest farm size that meet worth life living standard was 0.36 ha.

Keywords: MAD level, irrigation techniques, water use efficiency, income, sustainable upland agriculture.