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Abu Bakar Sambah, Dwi Agus Kuncoro, Syaiful Anam

TRACE IRRIGATION MAPPING THROUGH GEOSPATIAL ANALYSIS (CASE STUDY IN DI CIBULUH, WEST JAVA PROVINCE)

Abstract

Planning of irrigation canal has always faced the problems due to the overlapping of different land use. Irrigation planning should consider the irrigation canals surrounding different land use. Optimization of the determination of the irrigation network must be applied through the assumption of the physical condition of topographical as well as the proximity between irrigation canal and area of irrigation. The aims of this study were: (1) Mapping existing condition of irrigation canals in DI Cibuluh related to the land use and topography of the study area; (2) Mapping and determining the optimal trace irrigation networks based on spatial analysis of the existing land use and topographical characteristics; (3) Establish a simulation concepts of re-classification related to irrigation services area based on the elevation of the study area using geospatial analysis. The study was conducted through geospatial analysis methods in Geographic Information Systems. Digital Elevation Models (DEM) were the basic data in simulating irrigation services area. The results showed that there were two overlapping land use type (forests and industrial areas) that should be subtracted from the irrigated areas. Alignment of Irrigation network was planned without overlapping forest and industrial area, so that the planning was more focus on simulation based on the control points by processing adjustments as well as high elevation contour and water height.

Keywords: **Digital Elevation Model, geospatial analysis, irrigation planning, land use, mapping**

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UDC : 626.8

Widya Utaminingsih, Edy Anto Soentoro, Winskayati, Eko Winar Irianto

OPTIMIZATION OF LAND DEVELOPMENT BASED ON IRRIGATION AREA IN SOUTH SULAWESI PROVINCE

Abstract

Food security has been transformed into one of the strategic issue when it is related to the raise of population numbers and the high rate of irrigated land conversion into residential/industry. The increase of rice national production becomes one of the Government's key element to meet the national food necessity. The zonation mapping process to the irrigated area potency has been conducted, however, the further analysis to determine the land development policy is necessary in correspond with the raise of production cost and investment expense. This is essential to assess its development efficacy. The main purpose of this research is to examine the best scheme to boost up the national rice productivity, either through the extentification or the intentification processes and to calculate the minimum required of the investment cost. This research is focused on the analysis towards the irrigated area, whereas the location determination is referring to these two important aspects: 1) the zonation mapping potency of irrigated land development; and 2) the simulation of categorization of the national rice productivity. The optimization process has been investigated through Multi Criteria Decision Analysis (MCDA) along with the Analytical Hierarchy Process (AHP) method. Further more in-depth scoring criteria has been canducted with the compromise Programming and Promethee methods to figure out the development priority. The total Investment cost which acquired for the average irrigated area extensification was estimated around 105,6 million IDR/ha, henceforth, it is could be referred as the basis for budgeting- stipulation process for the future irrigated area development, with the production increase resulted from the abovementioned extensification of irrigated area was 5,02 tonnes/ha, or the cost of investment per production for the pertinent irrigated area intensification was 10,51 million IDR/ton.

Kata kunci: **extensification, intensification, investment cost, optimization, rice production**

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UDC : 626.8

Bastin Yungga Angguniko, Susi Hidayah

DESIGN OF MODERN IRRIGATION MANAGEMENT UNIT IN INDONESIA

Abstract

Establishment of irrigation management unit in Indonesia has been addressed by the 2015-2019 National Five Year Plan. The need is based upon the weak management of irrigation networks. Out of 3.3 million hectare of irrigation networks, 52% is in poor condition in 2014. Therefore, development of irrigation unit led by a single managing unit is considered as an appropriate measure for improvement. This research tries to determine the essential factors in creating a modern irrigation management unit (UPIM). The effort is carried out through the auditing of the current irrigation management practices within the central irrigation schemes, either under self-management or through support assignment. Result from field survey is then analyzed using SWOT method, followed by determining the key success factors for the management. There are five main functions of modern irrigation management which are; (1) programming and information system, (2) operation and maintenance controlling, (3) irrigation protection, (4) knowledge center and human resources, and (5) water use planning and counseling (PTGA). Both knowledge center and PTGA are the managerial innovation of this research. All of the functions are then arranged as an organizational structure designed according to each irrigation typology. For the sake of successful UPIM implementation, support in the form of legal decree as well as operation manual that could be easily understood by all stakeholders are needed.

Keywords: **agriculture, institutions, irrigation, management, modernization**

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UDC : 626.8

Vita Ayu Kusuma Dewi, Budi Indra Setiawan, Roh Santoso Budi Waspodo

ANALISYS ON WATER CONSUMPTION OF ORGANIC VEGETABLE IN PLANTHOUSE

Abstract

Organic vegetables grown special in planthouses require special irrigation practice to maintain the optimum range of soil water content throughout the cultivation season. The problem of irrigation is the absence of parameter that used to determine schedule and water irrigation. This research was to figure out whether the sprinkle irrigation used for Kailan vegetable in a planthouse could fulfil the water demand and the total water consumption based on change of water content. Herewith, the daily soil moisture was observed and analyzed the water flow in the soil based on the soil physical and hydraulic properties. The result showed that the soil water content was always within field capacity and permanent wilting point but 87% of cultivation period was lower than readily avaiable water (RAW). This condition indicated that the water irrigation is not optimal. Based on change of soil water content analysis, water consumption for kailan was 55 mm during cultivation with the consumption rate was 1.1 mm/day. The water requirement to attain RAW condition was 130 mm.

Keywords: **irrigation, planthouse, vegetable cultivation, water consumption, water content**

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UDC : 626.8

Riani Muharomah, Budi Indra Setiawan, M. Yanuar J. Purwanto

WATER CONSUMPTION AND REQUIREMENT OF LETTUCE IN FLOATING HYDROPONIC SYSTEM

Abstract

Floating hydroponic system (THST) is a hydroponic technique that its planting medium is placed on a floating styrofoam in a large pool that contains the nutrient solution. The common obstacles faced by this hydroponic technique is the absence of additional water during the growing season, so the water level in the pool is shrinking as the water is consumed by the plants. This study was to determine the rate of water consumption that fluctuated during the planting period and the water requirements which is necessary to maintain the water level. We found the averaged of lettuce water consumption was 0.74 mm/day. The accumulated water consumption for 54 days in two periods of growing season was 40 mm. The rate of lettuce water consumption at the beginning of the planting season was the smaller amounted to 0.75 mm/day and the greatest appeared at the end of the growing season equal to 2.09 mm/day. Finally, the water requirements to maintain the water level initially is 0.76 liters/day/m^2 and then increase until reaches 2.09 liters/day/m^2 at the end of the growing season or it is equivalent to 7.59 m^3 per 90 m^2 planting area.

Keywords: **hydroponics, lettuce, water level, water consumption, water requirement**

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UDC : 626.8

Nur Aini Iswati Hasanah, Budi Indra Setiawan, Chusnul Arif, Slamet Widodo

OPTIMUM WATER LEVEL FOR SYSTEM OF RICE INTENSIFICATION (SRI)

Abstract

Controlling water table is the way to manage water in SRI paddy field. Farmers tend to apply different water table depend on their local water management practices. It may have different effect on plant growth that can be seen in the number of tillers. In this study, tiller development of SRI paddy was studied by using experimental pots under various water tables treatments. The water table is controlled by using mariotte tube and set at -12, -7, -5, -3, 0, and +2 cm from the soil surface. The result shows that soil moisture (θ) were fluctuated due to intermittent irrigation and water table treatment. It affects the tiller growths rate that varied with average value 0.21-0.29 tiller/day. The first tiller appears at 18 days after transplanting (DAT). The tillers number keep increasing until reaching the highest number (around 63 to 72 DAT). This empirical study showed that setting water table at -5 cm under soil surface in SRI paddy cultivation is the best to reach high tiller number, and highest land and water productivity compare to another water table treatments. Consistency in producing tiller from beginning tiller production until the end of cultivation season could be seen from this treatment.

Keywords: **crop growth, mariotte tube, paddy, SRI, tiller, water table**

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UDC : 626.8

Waluyo Hatmoko, Radhika, Rendy Firmansyah, Anthon Fathoni

IRRIGATION WATER SECURITY AT RIVER BASIN AREAS IN INDONESIA

Abstract

Water security is the community's ability to maintain sustainability in meeting water demands for various purposes and managing water-related disasters. The score of Asian countries water security indicator has been formulated and calculated by the Asian Development Bank (ADB). However water security at the river basin level, including irrigation water security, has not been assessed. Like other Asian countries, irrigation in Indonesia is the largest water user, therefore irrigation water security plays important role in water resources management. This paper formulates and calculates the water security for irrigation in all river basins in Indonesia. The computation method is adopted from ADB, and developed according to the conditions of data availability and characteristics of river basins in Indonesia, under the assumption of homogeneity within river basin. It is concluded that the irrigation water security in the river basin in Indonesia is generally in "medium" condition. The "very bad" condition occurs only in Ciliwung-Cisadane and Progo-Opak-Serang river basins. The "bad" conditions include the Bangka, Belitung, Cidanau-Ciujung-Cidurian, Ciliman-Cibungur, Bali-Penida and Lombok river basins. Measures to improve irrigation water security are developing and improving

performance of irrigation networks, improve reliability of water supplies by constructing reservoirs and ponds, and reducing water stress with water savings.

Keywords: **indicators, irrigation, irrigation water security, water demand, water security, water supply**

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UDC : 626.8

Bono Pranoto, Sinta Nur Aini, Hari Soekarno, Afida Zukhrufiyati, Harun Al Rasyid, Santi Lestari

THE POTENTIAL OF MICROHYDRO IN IRRIGATION AREA (CASE STUDY IN SERAYU OPAK RIVER BASIN)

Abstract

Renewable energy development needs to be improved in order to overcome the problem of fossil energy sources that are increasingly depleted. Microhydro power plant is potential to be developed since Indonesia has a cluster of mountains where water spring can flow as sources of river water. In addition, microhydro is also potential from water flow in irrigation networks. There are more than 48 thousands irrigation areas in Indonesia that potential to be utilized to increase the energy security of Indonesia. However, the problem is there is lack of information on the potency of microhydro energy that can be generated from irrigation areas. This study aims to identify and make a map of the potency of microhydro energy in Irrigation Areas of Serayu Opak River Basin, and to know the potency of microhydro energy that can be generated in this region. The method used is to process image data through geospatial-based analysis and field verification. As a result, a map of the potency of microhydro energy has been produced and might be used as an indicative map showing irrigation channels which are potential for microhydro development. The amount of microhydro power in the irrigation area in Serayu Opak River Basin is about 26 MW.

Keywords: **irrigation area, mapping, microhydro potency, renewable energy, Serayu Opak River Basin**

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UDC : 626.8

Monica Rina Tutkey, Fatchan Nurrochmad, Sri Harto Brotowiryatmo

VERMICOMPOST EFFECT ON WATER HOLDING CAPACITY OF LOAM AND SANDY LOAM SOIL

Abstract

The water saving irrigation would be better if the soil can hold water maximally. The problem is the soils have different water holding capacity, some of them are less, so there is need to maximize the water holding capacity. Adding compost with the right composition can improve the soil physical properties, since organic matter in it has the aggregation capability that can bind the small granules to the large granules to improve the water holding capacity. This study aimed to analyze the maximum water holding capacity by adding 0%, 29%, 33%, 40%, 50%, 60%, 67% and 71% of vermicompost on loam and sandy loam soil. Each sample is repeated three times. PF curve was used to determine water holding capacity. The result shows that the maximum water holding capacity of loam soil is 19,14% by adding 40% of vermicompost or increased 13.56% from the original soil. On the other hand, adding vermicompost on sandy loam tends to decrease the water holding capacity. The maximum water holding capacity of sandy loam is 27.87% in 0% (original soil) of vermicompost. Further research can be continued by paddy plot trial using the best vermicompost composition and the water saving irrigation method.

Keywords: **pf curve, soil physical properties, vermicompost, water holding capacity, water saving irrigation**

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UDC : 626.8

Dwi Ariyani

RAINFALL AND AIR TEMPERATURE VARIABILITY AND ITS EFFECT TO THE IRRIGATION WATER BALANCE IN CILIWUNG WATERSHED

Abstract

Climate change is an issue that is being faced by the global community, which affects the variability of temperature and rainfall. An increase in air temperature may lead to a decrease in the dependable flow or availability of water. Related to this matter, this research aim to identify the trend of air temperature change and rainfall on water availability in Ciliwung Watershed for 30 years (1985 to 2015). Analysis of the increase in trend of climate variables is done by using Mann Kendall Trend Test method, water balance analysis using surplus deficit balance method, and water availability analysis using Mock method. The results showed no change in rainfall variability. The average temperature rose by 0.20C, the minimum temperature increased by 0.9^0C, and the maximum temperature rose by 0.8^0C over the last 30 years. Water availability decreased by 2 m^3/s or by 2,000 l/s during the last 30 years. Water balance analysis then conducted using the maximum irrigation water demand at the intake of 8.46 l/s/ha and the irrigation area of Katulampa Weir which was reduced from 1,288 ha to 333 ha (1985 to 2015). The results of this analysis indicate that there is no water balance deficit for agricultural land in Ciliwung Watershed. The result of this research is expected to support the management of water resources in the upstream Ciliwung Watershed.

Keywords: **Ciliwung, climate change, irrigation water, Katulampa, Mann Kendall, water availability, Mock, water balance**

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UDC : 626.8

Liliya Dewi Susanawati, Bambang Suharto

CROP WATER REQUIREMENT IN IRRIGATION SCHEDULING FOR ORANGE KEPROK 55 IN SELOREJO VILLAGE USING CROPWAT 8.0

Abstract

Keprok 55 (Citrus reticulate) is one of the horticulture commodities which are prioritized to be developed especially in Batu City, Malang. The main problem of Keprok 55 orange is water availability. Crop water requirement so far solely rely on rainfall which is erratic, particulary in the region of Selorejo. Therefore, proper irrigation management is needed, one of them is planning the crop water requirement. This study aims to plan and calculate needs of crop water requirement using Cropwat 8.0 software and evaluate the result with the actual condition. The research was conducted at orange orchard in Selorejo Village, Dau District, Malang Regency. This research uses quantitative descriptive analysis and data processing using Cropwat 8.0. The results showed that the total crop

water demand (ETc) during the growth period was 971.90 mm with the highest actual evapotranspiration of the plants reached in October, the third period of 34.80 mm and the lowest in the third February of 19.70 mm. The result from Cropwat 8.0, are very helpful in determining the cropping season and the amount of irrigation for planning purpose. However, day to day operation must be conducted based on actual crop and rainfall condition to maintain soil moisture at appropriate level to support crop growth.

Keywords: **actual evapotranspiration, Cropwat 8.0, crop water requirement, irrigation scheduling, orange keprok 55**

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UDC : 626.8

Dadan Rahmandani, Eko Winar Irianto, Hanhan A. Sofiyuddin, Susi Hidayah, Iwan Hadihardaja, Edy Anto Soentoro

EVALUATION OF WATER DELIVERY ACCURACY USING IRRIGATION OPERATING MANAGEMENT SYSTEM (SMOI) IN BONDOYUDO IRRIGATION AREA

Abstract

Irrigation Operation Management System (SMOI) is an irrigation reporting information system designed to automate data transfer and form reporting by utilizing the internet network. SMOI can shorten the time of reporting and facilitate the evaluation of historical data in support of decision making in an Irrigation Area. Nevertheless, this technology has not been tested on field-scale applications especially in multiple districts irrigation area. The study aimed to analyze the accuracy of SMOI calculations and the correctness of water delivery as the impact of the SMOI application. The research was conducted on the application of SMOI in Bondoyudo Irrigation Area, East Java. The analysis of the calculation accuracy is done by verifying and validating the results of SMOI calculation compared to the calculation of manual form. Analysis of water delivery accuracy is done through water balance simulation based on data in Cropping Season I and II year 2016/2017. Based on the result, the calculation workflow, data retrieval, and flow of data distribution among forms on SMOI in accordance with the provisions in PUPR 12/PRT/M/2015. The simulation results show that SMOI can improve the accuracy of water delivery to the predicted value by 40.7% in Cropping Season I and 21.8% in Cropping Season II. However, when compared with actual irrigation water needs, SMOI has not significally to improved water delivery accuracy. This is due to the calculation of water requirements in manual form and SMOI not yet accommodating the variability of actual climatological conditions.

Keywords: **SMOI, irrigation operations, calculation workflow, water delivery, accuracy, modernization of irrigation**

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EDITORIAL

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Ketahanan air nasional saat ini telah menjadi topik yang banyak diperbincangkan. Nilai indikator ketahanan air pada negara-negara di Asia telah dirumuskan dan dihitung oleh Asian Development Bank (ADB), namun ketahanan air pada tingkat wilayah sungai, termasuk juga ketahanan air irigasi masih belum dikaji. Artikel pembuka pada edisi ini membahas mengenai kondisi ketahanan air irigasi pada wilayah sungai di Indonesia dengan membuat kategori wilayah sungai kedalam beberapa kondisi (sangat baik, baik, sedang, buruk, sangat buruk). Nilai ketahanan air pada setiap wilayah sungai diidentifikasi berdasarkan indikator-indikator yang telah dirumuskan beserta data pendukungnya. Upaya yang dapat dilakukan untuk meningkatkan ketahanan air irigasi berdasarkan kategori kondisinya dapat menjadi bahan masukan terhadap pengembangan sumber daya air, khususnya pengembangan irigasi pada wilayah sungai di Indonesia.

Indonesia memiliki sumber daya air dan kondisi topografi yang cukup baik untuk pemanfaatan tenaga mikrohidro, di sisi lain Indonesia memiliki begitu banyak potensi air yang belum dimanfaatkan secara optimal. Artikel selanjutnya mengkaji potensi energi mikrohidro di saluran irigasi yang dilakukan melalui analisis geospasial untuk menentukan lokasi dan potensi pembangkitannya. Hasil analisis menunjukkan bahwa peta potensi energi mikrohidro di saluran irigasi yang dihasilkan dapat digunakan sebagai peta indikasi awal lokasi-lokasi yang memiliki potensi untuk membangkitkan energi di sepanjang saluran irigasi.

Saat ini sistem irigasi hemat air telah banyak diterapkan sebagai solusi dalam mengoptimalkan penggunaan air dengan tidak mengurangi hasil produksi padi. Sistem ini akan menghasilkan manfaat optimal bila didukung kondisi tanah yang mampu mengikat air dengan baik. Artikel selanjutnya mengkaji pengaruh pemberian pupuk kascing terhadap kemampuan mengikat air pada tanah lempung dan lempung berpasir. Komposisi terbaik pupuk kascing yang diidentifikasi dalam penelitian ini dapat dijadikan dasar untuk memperbaiki dan mengoptimalkan kemampuan tanah untuk mengikat air.

Perubahan iklim merupakan isu yang sedang dihadapi oleh masyarakat global, yang berpengaruh terhadap variabilitas suhu udara dan curah hujan. Peningkatan suhu udara dapat menyebabkan penurunan debit andalan atau ketersediaan air. Terkait dengan hal tersebut, artikel selanjutnya membahas mengenai variabilitas curah hujan dan suhu udara serta pengaruh nya terhadap neraca air irigasi di Daerah Aliran Sungai (DAS) Ciliwung. Analisis *trend* dan neraca air dilakukan menggunakan data historis sepanjang 30 tahun. Hasil dari penelitian ini diharapkan dapat menjadi bahan masukan untuk pengelolaan sumberdaya air di daerah hulu DAS Ciliwung.

Irigasi salah satunya bertujuan untuk menjaga lengas tanah pada kondisi yang sesuai untuk mendukung pertumbuhan tanaman yang optimal. Perencanaan irigasi yang tepat perlu dilakukan berdasarkan kondisi lokal. Artikel selanjutnya membahas mengenai penggunaan *software Cropwat* 8.0 untuk perencanaan irigasi tanaman jeruk Keprok 55 (*citrus reticulate*) di wilayah Kota Batu, Malang yang memiliki ketersediaan air irigasi terbatas. Hasil evaluasi menunjukkan bahwa *software Cropwat* 8.0 menghasilkan nilai yang tepat untuk perencanaan musim tanam dan kebutuhan air irigasi. Namun demikian, pengoperasian irigasi harian perlu dilakukan berdasarkan kondisi aktual untuk menjaga lengas tanah pada rentang yang sesuai untuk pertumbuhan tanaman.

Modernisasi irigasi di Indonesia didefinisikan sebagai upaya mewujudkan sistem pengelolaan irigasi partisipatif yang berorientasi pada pemenuhan tingkat layanan irigasi secara efektif, efisien dan berkelanjutan dalam rangka mendukung ketahanan pangan dan air. Operasi jaringan irigasi merupakan salah satu bagian dari pilar modernisasi irigasi, yaitu pada pilar sistem pengelolaan irigasi. Saat ini proses pelaporan operasi irigasi masih dilakukan secara manual melalui pencatatan pada blangko operasi irigasi. Proses pelaporan ini memerlukan waktu yang cukup lama, lebih sulit dianalisis dan lebih sulit dirunut, sehingga pengambilan keputusan pembagian air juga lebih sulit dilakukan. Sistem Manajemen Operasi Irigasi (SMOI) merupakan sistem informasi pelaporan operasi irigasi yang didesain untuk melakukan pengiriman data dan blangko operasi irigasi secara otomatis dengan memanfaatkan jaringan internet. Artikel terakhir edisi ini akan menganalisis keakuratan perhitungan SMOI dan menganalisis ketepatan pemberian air sebagai dampak dari aplikasi SMOI di Daerah Irigasi Bondoyudo, Jawa Timur.

Semoga naskah-naskah yang kami sajikan dapat bermanfaat dan memperkaya ilmu. Akhir kata Redaksi mengucapkan selamat membaca.

Redaksi