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Elias Wijaya Panggabean, Bangkit Aditya Wiryawan

POLICY STRATEGY OF TIDAL LOWLAND IRRIGATION DEVELOPMENT IN BELAWANG AREA, PROVINCE OF SOUTH KALIMANTAN

Abstract

Swamp reclamation project that had been carried out by the Government of Indonesia in Sumatra and Kalimantan few decades ago was primarily aimed at strengthening national food security and transmigration project. However now, contribution of tidal swamp farming to national food security is still low. Instead, nowadays there are more irrigated swamp land that had been converted into oil palm or rubber plantations. Irrigated swamp field of Belawang (Barito Kuala Regent) is one of the area which had been widely converted to rubber plantations. Many factors lead to these phenomena. This study examined the key factors that led to land conversion and followed by formulating strategies to promote the role of irrigated swamp fields in supporting food security. The research was conducted in 2014 under quantitative approach and using SWOT analysis method. Data were obtained through in-depth interview towards key informants. This study suggested that the strategy for the development of irrigated tidal swamp in Belawang should be carried out by remapping the appropriate swamp type for food crops and plantations. Furthermore, planned commodity diversification is the answer for food security and local economic problems.

Keywords: **tidal swamp, land conversion, strategies, crops, plantation**

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UDC : 626.8

Hanhan Ahmad Sofiyuddin, Tasuku Kato, Ryota Tsuchiya

KETIDAKPASTIAN MODEL SWAT DI DAERAH ALIRAN SUNGAI BERLAHAN SAWAH IRIGASI

Abstrak

Soil and Water Assessment Tool (SWAT) merupakan model hidrologi yang sangat berpotensi digunakan untuk memodelkan daerah aliran sungai yang didominasi lahan pertanian. Namun demikian, struktur model ini dapat menyebabkan ketidakpastian khususnya apabila diaplikasikan untuk lahan sawah beririgasi. Hal ini dikarenakan SWAT pada awalnya dikembangkan untuk memodelkan lahan pertanian yang tidak memiliki genangan sehingga asumsi ataupun struktur modelnya berbeda dibandingkan dengan konsep pemodelan yang biasa digunakan di lahan sawah. Namun demikian, tingkat pengaruh ketidakpastian ini terhadap performa model secara keseluruhan belum teridentifikasi secara detail. Penelitian ini bertujuan untuk menganalisa performa, kesesuaian aplikasi dan ketidakpastian SWAT (model awal dan modifikasinya) untuk memodelkan daerah aliran sungai berlahan sawah irigasi. Analisa dilakukan dengan mengevaluasi struktur model dan menganalisa ketidakpastian menggunakan metode Sequential Uncertainty Fitting (SUFI-2) pada beberapa tipe model, yaitu model orisinil dan termodifikasi. Berdasarkan hasil penelitian, dapat disimpulkan bahwa struktur model pada SWAT tidak mengakomodir proses genangan, rembesan, dan irigasi di lahan sawah. Pengaruh dari ketidaktepatan struktur model ini dapat dikurangi dengan melakukan kalibrasi sehingga menghasilkan indeks performa yang baik. Namun demikian, perbedaan performa secara signifikan dapat diamati setelah dianalisa lebih lanjut dengan memperhatikan ketidakpastian. Reliabilitas model termodifikasi lebih baik karena menghasilkan rentang ketidakpastian yang lebih sempit khususnya pada periode debit rendah. Hasil ini juga menunjukkan bahwa genangan, rembesan, dan irigasi merupakan proses yang sangat penting untuk pemodelan hidrologi di daerah aliran sungai berlahan sawah irigasi.

Kata kunci: **SWAT, SWAT termodifikasi, sawah, debit sungai, analisis ketidakpastian, SUFI-2**

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Najla Anwar Fuadi, M. Yanuar J. Purwanto, Suria Darma Tarigan

STUDY ON WATER REQUIREMENT AND WATER PRODUCTIVITY OF PADDY FIELD WITH SRI AND CONVENTIONAL WATER SUPPLY SYSTEM BY USING PIPE IRRIGATION

Abstract

Limited water availability for agricultural land may cause decrease in rice production. The increase of crop production currently become a top priority in agricultural development. Productivity can be assessed through a subsystem of soil, water, and land patterns to use in certain periods. The applications of pipe irrigation with the combination of System of Rice Intensification (SRI) was capable to use water efficiently. Therefore, research concerning the calculation of water productivity of paddy rice which uses input pipe irrigation with conventional water supply system and SRI system is important to be conducted. The research steps were direct observation in the field, measurement of evapotranspiration, percolation, net field requirements and calculation of water productivity. The results showed that the production of rice was higher in water delivery system of SRI. Water productivity of paddy with SRI system also higher, where the water needs with a combination of pipe irrigation and water delivery systems in SRI were the best treatment. Water productivity in conventional rice fields was 0.82 kg/m3 and SRI 1.12 kg/m3. The combination of pipe irrigation and SRI systems showed high water productivity and efficient use of water.

Keywords: **water productivity, paddy, pipe irigation, SRI, water efficiency**

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Afri Fajar, M. Yanuar J. Purwanto, Suria Darma Tarigan

EFFICIENCY OF PIPE IRRIGATION SYSTEM TO IDENTIFY THE FEASIBILITY OF WATER SUPPLY IN IRRIGATION WATER MANAGEMENT

Abstract

Irrigation water loss that commonly occurs in an agricultural area are runoff and deep percolation. Pipe irrigation has reached 98% efficiency because it can control the use of water as needed and has no seepage for water supply. Distance of paddy field's inlet should also be a considered factor aside from irrigation technology. Rice field's inlet distance affect the water distribution in a fields plot as they relate to application efficiency (Ea) and the efficiency of water distribution (Ed). The method used in this research was descriptive method that collect primary data and secondary data. The experiment plots were installed with irrigation pipes. The results showed Ed values above 90% in conventional and System of Rice Intensification (SRI). This explains the distribution of water in pipe irrigation evenly throughout the planting area. Ea value on experimental plots ranged between 76% - 98%. This is because of the occurrence of deep percolation and surface flow at the conventional fields, which causes decrease in efficiency. The paddy field inlets distance simulation results showed that good Ea (≥ 90%) obtained at a distance of 30 m with SRI water application gave water saving up to 10,25%. The feasibility of the water application on the value of Ea was obtained from the level of application of irrigation water's pattern to conventional paddy at vegetative phase is critical at a distance of 170 m, while the generative phase is critical at a distance of 75 m and very critical at 178 m. SRI paddy field gives the value of feasibility of providing water at vegetative phase becomes near critical at a distance of 170 m, while the generative phase becomes critical at a distance of 150 m.

Keywords: **pipe irrigation, distribution efficiency, applications efficiency, SRI, inlet, water saving**

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UDC : 626.8

Ahmad Tusi, Budianto Lanya

DESIGN OF PORTABLE SPRINKLER FOR PAKCHOY PLANT

Abstract

Sprinkler irrigation is one of the most efficient and effective effective irrigation. However, on-site application of sprinkler irrigation systems has encountered many obstacles, including the initial investment and operational costs. This study aimed to design a sprinkler irrigation system which saves the initial investment cost and simple in operation and maintenance, especially in the area where agricultural land were separated and small in area (0.10 to 0.30 ha) or without irrigation facilities. The research method in this study were the determination of the length and diameter of the pipe based on analysis of hydraulic pipe in lateral, manifolds and main pipe; sprinkler discharge calculation with volumetric method; and determination of irrigation uniformity with Christiansen method. The portable sprinkler irrigation system has specification: sprinkler nozzle head Impact Plactic type with nozzle size 4 mm, total height riser stick 1.3 meters in diameter ¾" elastic lateral pipe with a diameter of 2" and length 50 meters, pipe sub-main (manifold) and the main pipes of 2". The pump has a total head of 55 meters with a driving power of 5.5 HP, and suction hose 2". This sprinkler irrigation system can operate at operating pressure 1 to 4 bar. The discharge of sprinkler at a pressure of 1 bar is 0.12 l/s. Irrigation uniformity value resulted at a pressure of 1 bar was at 80%. To obtain the value of irrigation uniformity of more than 85%, it is advisable to use a minimum operating pressure of 2 bar.

Keywords: **design sprinkler, hydraulic, sprinkler irrigation, irrigation uniformity, technology**

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Eko Winar Irianto

HIDRODYNAMIC ANALYSIS FOR HYDRAULIC-ROTARY DISTRIBUTOR ON EGA-SATTIRA TECHNOLOGY AND ITS DEVELOPMENT FOR DRIP-ROTARY IRRIGATION

Abstract

Trickling filter is a wastewater treatment technology which has high effiency on organics reduction but low energy on its operation. Ega Sattira is the combined technology between constructed wetland and trickling filter technologies. One of the success on its treatment process is due to the hydraulic-rotary distributor. Hydrodynamic analysis on hydraulic-rotary distributor is required for making better and more efficient on Ega-Sattira's operation and process system. The research objectives are: (a) to analize and formulate the hydrodynamic model on movement-force mechanisme of hydraulic-rotary distributor on Ega Sattira technology; (b) to utilize the the phenomenon of hydraulic-rotary distributor as an alternatif of drip-rotary irrigation technique which is part of water efficient irrigation; 3) to propose the basic desain on drip-rotary irrigation system that is easy, cost efficient and efficient in operation and maintenance. The results of hydrodynamic analysis shows that rotation number per time unit is directly proportional to the gravity acceleration, friction coefficient and root of the water level in the tank and critical flow coefficient, but inversely proportional to the diameter of rotary-distributor pipe. Calibration trial result between counting rotation and actual rotation resulted the equation Y= 0,0014X dengan r2= 0,82. The formulation result can be applied to the planning of hydraulic-rotary irrigation system supporting the technology of water-saving irrigation.

Keywords: **trickling filter, domestic wastewater, hydrodynamic analysis, rotary distributor, rotary irrigation**

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UDC : 626.8

Heni Rengganis

POTENTIAL AND UTILIZATION GROUNDWATER FOR DRYLAND IRRIGATION IN NUSA TENGGARA

Abstract

Nusa Tenggara region has a vast dry land area but they are very potential to be developed. The water availability as one of the determinants has a role in helping to increase productivity in an effort for dry land utilization. Groundwater potential can be technically applied for dry lands irrigation in Nusa Tenggara. This paper provided the study results of both potential and groundwater utilization as irrigation water resources in dry land in Nusa Tenggara, by considering groundwater potential resource, land conditions, plants variety, and water supply technology. The method used is

descriptive analysis by collecting primary and secondary data through visits to several related agencies, literature studies, and field surveys. These results provide further proposed groundwater development through the conjuctive use of surface water and groundwater. Moreover, the results are expected to be used either in the proposed water resources management policy in the area or as feedback to stakeholders in groundwater utilization, particularly in the dry land as well as for further research.

Keywords: **groundwater, dryland, irrigation, groundwater potential, water supply technology**

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Chusnul Arif, Budi Indra Setiawan, Deka Trisnardi Munarso, Muhammad Didik Nugraha, Paradha Wihandi Simarmata, Ardiansyah, Masaru Mizoguchi

GLOBAL WARMING POTENTIAL FROM SYSTEM OF RICE INTENSIFICATION PADDY FIELDS WITH VARIES WATER LEVELS

Abstract

System of Rice Intensification (SRI) is known as alternative rice farming for the mitigation of greenhouse gas (GHG) emissions. There are two main gasses emitted from paddy fields, i.e., methane (CH_4) and nitrous oxide (N_2O). Both of these gases have different characteristics as response on water availability in the fields which is represented by groundwater levels. Global Warming Potential (GWP) is used as an index that allowed comparisons of the global warming impacts of different gases at specific time period to warm the earth and it is equivalent to the value of the potential of CO_2. This study aimed to analysis the global warming potential from different water regimes with SRI practices. Achieving the objective, rice cultivation with three water regimes was carried out during one planting season (14 April until 5 August 2016) in experimental plots of Department of Civil and Environmental Engineering IPB, Bogor, Java West. The regimes were continous flooding, moderate and dry regimes, respectively. The results showed that dry regime has the lowest global warming potential than those others regimes. Its potential was 34% and 41% lower than those for flooding and moderate regimes, respectively. In addition, dry regime produced more grain yield. Its productivity was 21% greater than that flooding regime. These results were obtained from specific climate and location. To corroborate the results, further research is needed under different weather conditions and multi-locations.

Keywords: **greenhouse gasses, global warming potential, system of rice intensification, water levels, water regime**

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UDC : 626.8

Denik Sri Krisnayanti, Very Dermawan, M. Sholichin, Suhardjono, Dian Noorvy Khaerudin

STEPPED WEIR AS AN ALTERNATIVE DESIGN OF IRRIGATION STRUCTURE

Abstract

Stepped weir is generally a modification on the downstream face of a standard ogee weir. The overflow on stepped weir classified in to three types: nappe flow, transition flow, and skimming flow. The skimming flow more used in planning the weir because almost all the operations of weir for large discharge. This study aimed to investigate and examine the advantages of stepped weir by conducting variations models such as slope angle of weir, number of steps, and the value of Froude number. In this research, the models test of stepped spillway carried out with two models of weir type were the ogee weir and the stepped weir. The slope of stepped spillway (θ) are used 30˚ and 45˚, the number of steps (N) are 40 and 20, and the critical depth to the height of steps (y_c/h) ranging from 0,700 <y_c/h<3.00 with the Froude number (Fr)< 10. The results showed that friction factor of Darcy-Weisbach (f) for the stepped weir is 0.311 which affect the value of energy loss. Levels of dissolved oxygen at stepped weir flow increased by 2.011% - 2.846%. The value of relative energy losses ($\Delta E_1/E_0$) are 86.129% on the stepped weir and 72.466% on the ogee weir. The increase in value relative energy loss will affect the length of stilling basin in the downstream.

Keywords: **stepped weir, relative energy loss, dissolved oxygen, skimming flow, friction factor**

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Eri Gas Ekaputra, Delvi Yanti, Deni Saputra, Fadli Irsyad

DESIGN OF DRIP IRRIGATION SYSTEM FOR CHILI (*CAPSICUM ANNUM L.*) CULTIVATION IN GREENHOUSE IN NAGARI BIARO, DISTRICT AMPEK ANGKEK, AGAM REGENCY, WEST SUMATERA

Abstract

Chili plants (*Capsicum Annum L.*) requires the availability of water in sufficient quantities and timely. The situation can be achieved by the application of drip irrigation system. This is due to the system can set the amount and timing in accordance with the water requirements of chili plants. This research was conducted in Nagari Biaro, District Ampek Angkek, Agam regency which aims to design a drip irrigation system that is suitable and appropriate for chili cultivation in the greenhouse. In this study, observations were conducted to the evapotranspiration of chili (ETC), technical testing, and feasibility analysis of drip irrigation systems. Based on the research results, highest ETc of 2.16 mm/day was occurred in the period from the beginning of the generative phase, with an average discharge droplets of 137.685 mm3/sec, the system operated for 0.84 hours/day to meet the water needs of chili plants. However, by considering the three parameters of technical feasibility, the system is still not feasible because there was only one that fits the required value, namely the distribution efficiency (91.49%). The uniformity (76.97%) and irrigation efficiency (74.37%) have not yet reached the minimum required value of 90%, this is caused by differences in head and the length of each channel, thus the pressure on the line was not uniform which causing varied discharge droplets.

Keywords: ***Capsicum Annum L.*, crop water requirement, drip irrigation, irrigation efficiency, irrigation system**

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UDC : 626.8

Susi Hidayah, Aditya Prihantoko

ELECTROMECHANICAL IRRIGATION GATE WITH OVERFLOW AND UNDERFLOW COMBINATION

Abstract

Discharge adjustment in an essential activity in irrigation network. This commonly done using underflow irrigation gate (e.g. sliding gate) which have disadvantages regarding the hydraulic property of flow and floating debris. The overflow irrigation gate (e.g. skot beam) can overcome this but is difficult to operate. It is necessary to combine the important features of both structures so that the disadvantages can be avoided. This paper explains results on the development of double flow sliding gate with underflow and overflow combination which is designed to overcome the undesired hydraulic properties (energy loss) and inaccuracies of flow measurement because of sedimentation. The gate was designed to be easily operated using a solar powered electromechanical system that can be monitored and controlled remotely. Additionally, the gate also built using alternative materials that are GFRP honeycomb composite. The method used is laboratory and field tests on the designed double flow irrigation gate. Physical test results showed the value of materials qualified with predicted loading on the gate. The hydraulic test provided that the gate can predict discharge accurately during water level of 10, 20, and 30 cm. The gate can also control discharge effectively to fulfill fluctuating water balance needs in the service area. This results could be used as a reference to apply the concept of double flow sliding gate which is stated in the Indonesia Irrigation Planning Criteria 08, 2013.

Keywords: **gate, combination, overflow and underflow, GFRP, double flow sliding gate**

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Marasi Deon Joubert, Dadang Ridwan, Ratna Manik Pratiwi

PERFORMANCE OF GROUNDWATER IRRIGATION SYSTEM ON DRIP IRRIGATION USING SOLAR WATER PUMP

Abstract

Groundwater Irrigation Network (JIAT) contributes substantially to agricultural production especially in the dry season. Limited water availability needs to be handled by water-efficient irrigation methods. JIAT which is built in Ponorogo has not been optimally utilized yet. So, it needs to be revitalized using both drip irrigation and solar energy system to operate the submersible pump. This study uses 51 solar panels covering area of 120 m^2. Evaluation resuts of the technology application shows that solar energy can generate 7,873.5 watts, maximum discharge 14.17 liter/second, average CO_2 emission reduction 4.1 kg/day, 96.51% irrigation uniformity, drip uniformity of 97.72% and emitter rate of 3.99 mm/hr. CO_2 emission can be reduced until 1.29 tons for one pump operation on 10 consecutive months. Moreover, potential reduction of CO_2 will reach 4.506 tons in a year if 50% of JIAT pumps from 7,000 existing pumps can be converted to be solar-based pumps. Water productivity for the cultivation of watermelon plants can be achieved as 35.63 kg/m^3 water. The water-use efficiency is 60% - 92% compared to the similar research. In addition, pump-operation costs can be decreased to 94.92% compared to the cost of diesel-fueled pump.

Keywords: **JIAT, solar cell, water saving irrigation, drip irrigation, water pump**

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Halaman

EDITORIAL

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Permasalahan dalam pendayagunaan air tanah pada lahan kering bervariasi pada setiap wilayah, baik aspek teknis, sosial-ekonomis termasuk pengelolaannya. Wilayah Nusa Tenggara memiliki hamparan lahan kering yang luas dan berpotensi untuk dikembangkan. Artikel pertama edisi ini merupakan sebuah kajian yang bertujuan untuk mendapatkan informasi mengenai pemanfaatan dan pengembangan air tanah untuk irigasi di lahan kering. Hasil kajian ini diharapkan dapat menjadi rujukan dalam usulan kebijakan pengelolaan air tanah untuk irigasi di daerah dan masukan untuk pemangku kepentingan dalam rangka pendayagunaan air tanah serta untuk para peneliti dalam mengembangkan penelitian.

Perubahan iklim yang terjadi saat ini sangat mempengaruhi kehidupan masyarakat di berbagai sektor. Perubahan iklim tersebut disebabkan oleh pemanasan global yang dipicu oleh peningkatan konsentrasi Gas Rumah Kaca (GRK) di atmosfer. *System of Rice Intensification* (SRI) merupakan salah satu alternatif strategi mitigasi GRK dari lahan sawah. Artikel kedua edisi ini membandingkan potensi pemanasan global yang dihasilkan dari berbagai rezim air dengan ketinggian muka air yang berbeda pada lahan sawah SRI dengan menganalisis pengaruh tinggi muka air terhadap produksi tanaman, menganalisis pengaruh tinggi muka air terhadap emisi gas CH_4 dan N_2O dan mengukur potensi pemanasan global yang dihasilkan pada setiap rezim air.

Bendung bertangga merupakan modifikasi saluran peluncur dengan membuat beberapa tangga dari lokasi dekat puncak bendung sampai kaki di hilir bendung. Tujuan utama dari bendung bertangga adalah meningkatkan peredaman energi karena masuknya udara pada dasar aliran semu (*pseudo bottom*) dan mengurangi kelebihan energi kinetik yang terjadi pada saluran luncur. Artikel ketiga edisi ini akan menganalisis perilaku hidraulik bendung bertangga pada kondisi aliran tenggelam, parameter terpenting yang bisa diamati adalah jumlah anak tangga yang berpengaruh terhadap kehilangan energi. Peningkatan nilai kehilangan energi relatif akan mempengaruhi terhadap panjang kolam olak di hilir bendung, dengan demikian penggunaan bendung bertangga pada bangunan irigasi dapat menjadi alternatif untuk menekan biaya konstruksi pada tubuh bendung.

Selama ini masyarakat belum begitu banyak menggunakan irigasi tetes untuk budidaya tanaman cabai, khususnya di Sumatera Barat. Budidaya cabai masih banyak terkendala oleh hama penyakit, kondisi iklim yang kurang kondusif, serta budidaya yang kurang intensif. Artikel selanjutnya merupakan penelitian yang bertujuan untuk merancang sistem irigasi tetes yang sesuai dan tepat guna untuk budidaya tanaman cabai dalam rumah tanaman. Hasil dari penelitian ini diharapkan dapat memberikan alternatif solusi terhadap kelangkaan cabai yang terjadi di Provinsi Sumatera Barat dan bisa dijadikan acuan dalam usaha budidaya tanaman cabai dengan menggunakan sistem irigasi tetes dalam rumah tanaman.

Irigasi di Indonesia sebagian besar menggunakan pintu sorong dalam pelaksanaan operasi jaringan irigasinya, pintu sorong ini termasuk dalam pintu pembilas bawah yang memiliki banyak kekurangan. Artikel selanjutnya adalah penelitian mengenai pintu air irigasi elektromekanis kombinasi aliran atas dan bawah, penelitian ini mampu mengatasi banyak permasalahan, diantaranya yaitu kehilangan energi dan ketidakakuratan bangunan ukur karena sedimentasi. Penelitian ini juga mampu memberikan beberapa kemudahan, seperti pengoperasian pintu air irigasi yang digerakkan secara elektromekanis, serta monitoring dengan kontrol jarak jauh dalam pelaksanaan operasi pintu, terutama pada lokasi yang jauh dari pemukiman dengan menggunakan sumber energi alternatif.

Guna mendukung program revitalisasi Jaringan Irigasi Air Tanah (JIAT) yang telah dibangun oleh Kementerian Pekerjaan Umum dan Perumahan Rakyat, artikel terakhir edisi ini menyajikan penelitian mengenai model JIAT berbasis pompa air tenaga surya dan irigasi hemat air. Penelitian ini mengkaji penerapan irigasi hemat air dalam rangka menyusun model sistem optimalisasi JIAT nonpadi. Hasil pengembangan sistim JIAT dan uji coba di lapangan menunjukkan bahwa biaya operasi dapat ditekan hingga 94,92% dan efisiensi penggunaan air irigasi lebih dari 60-92%, dibanding dengan sistem JIAT yang ada. Penelitian ini merupakan penelitian tindakan, melalui penerapan langsung di lapangan berskala penuh (*full scale*), dengan pendekatan partisipatif.

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

Redaksi