American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN: 2320-0936
Volume-8, Issue-10, pp-123-127
www.ajer.org
Research Paper Open Access

# Optimizing Planting Patterns in Sei Seluang Wetland Irrigation Area Barito Kuala Regency

Muhammad Kafid Maskuri, and Mahmud Mahmud*
*Department of Civil Engineering, Lambung Mangkurat University, Banjarmasin city, Indonesia*
**Corresponding Author: Muhammad Kafid Maskuri*

***ABSTRACT :*** *Wetland Irrigation Area of Sei Seluang, Barito Kuala Regency, has a standard area of 4564 Ha and a functional area of 3300 Ha. The planting system in Sei Seluang Wetland Irrigation Area is rice/secondary crop (bera-palawija) which was still not optimal, however the potential to be optimized could be implemented because according to researchers, the availability of water in the study location was sufficient for crop needs.The research objectives were to identify water needs for plants and the availability of water for plants as well as water balance, to determine the right alternative planting patterns, so as to get optimal results in land management in Sei Seluang Wetland area, Barito Kuala regency.The results of linear programming optimization with the QM for Win tool show the optimal area for rice field (X1) = 1498 Ha, while the area of secondary crop was 470 ha. There was a reduction in the area of rice that could be irrigated from the existing conditions of 2010 Ha of rice field. While the maximum profit from the optimization results was Rp 2,936,726,800 which was still higher than the existing condition of Rp 2,814,000,000.*

***KEYWORDS:water balance; tides; planting pattern; optimization.***

---

Date of Submission: 06-10-2019 Date of acceptance:22-10-2019

---

## I. INTRODUCTION

Wetland Irrigation Area in Sei Seluang, Barito Kuala Regency, is a tidal wetland type with a functional area of 3300 ha. All of these networks have been used by local communities as rice and secondary crops, but in reality, the type of rice generally cultivated by farmers is the type of local Siamese rice which is 6-7 months old. This type of rice is favored by local farmers because in addition to its taste preferred by the community, it is considered easy to cultivate, minimal production input, and high selling prices. However, this type of rice has weakness, its longevity and small production yields.

The agricultural improvement program has been carried out through the local Agriculture Service with the first planting season (MT-1) pattern for superior types of Impara 3 rice, usually starting in October-December with the harvest season usually in February-March. Then, it was continued with local rice planting (MT-2) in March-April with harvest time in August-September. Then the land was given up because in reality, not all land can be planted twice a year. Seeing the condition of farming in such a research location with all its potential and limitations, it was necessary to develop a development concept to increase the results of farming which would automatically increase farmer's income, thereby reducing their tendency to convert their land into palm or rubber plantations. Optimizing cropping patterns based on the availability of existing water was one of the choices for agricultural development efforts at the research location.

The purpose of this study is to identify the availability and demand of water, obtain optimal planting patterns and area in land management in irrigation area of Sei Seluang Barito Kuala Regency and get an idea of the potential increase in planting area and farmer income in the study location.

## II. RESEARCH METHOD

In collecting primary data, field surveys and interviews with farmers were carried out to determine the location of the study and the problems in accordance with the literature review used, while the secondary data collection was from various sources and related agencies needed in the form of climatology data and the existing conditions of the Sei. Seluang Irrigation Are, Barito Kuala Regency.

The data required including:

- Network scheme of Sei Seluang Wetland Irrigation Area to determine the discharge plan used by rice fields.
- Existing land use data
- Implemented planting patterns data by farmers.
- Reliable discharge and existing discharge data
- Rainfall data for hydrological analysis.
- Climatology data such as humidity, temperature, solar radiation, and wind speed used for evapotranspirationand other analysis.

Research stage are shown below:

- Calculating the availability of water from effective rainfall as the growth of rice and secondary crops.
- Analyzing the Water Needs with the Modified Penman Method based on climatological data.
- Analyzing whether there was enough water or water balance against the planting patterns and planting schedules at certain times.
- Optimizing the planting patterns with Linear Program which has three important elements (Montarcih, 2008), namely: decision variables, objective variables and constraint variables.

## III. RESULT OF DISCUSSION

### A. RAINFALL

The largest average of monthly rainfall was found in January, amounting to 279.24 mm, while the smallest was in September, amounting to 48.02 mm. The wet month started in October. Whereas the distribution of rainfall, the rainfall above 50 mm and occurring 3 times in a row started in December and ended in May. This was important as a basis for determining the beginning of the growing season.

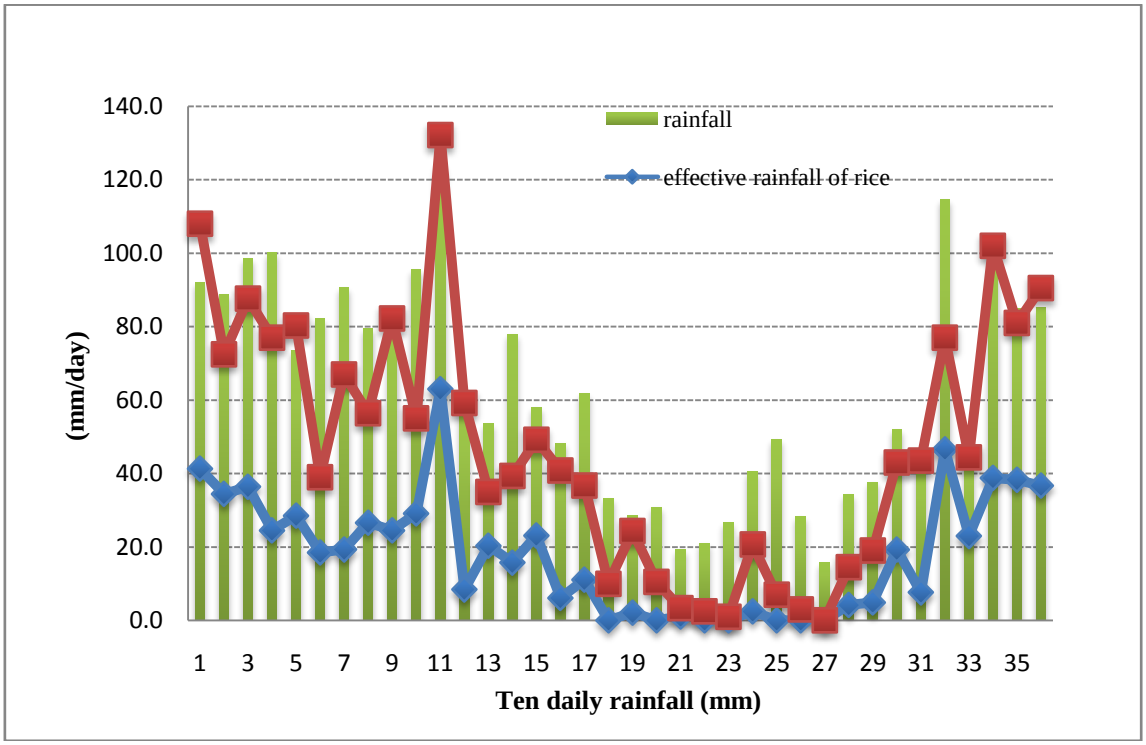


**Fig.1. Relationship between effective rainfall of rice and palawija and ten daily rainfall**

### B. EVAPOTRANSPIRATION

In this case, the calculation used Penman Modification Method, with the following results:

**Table 1 The results of evaporation calculation with the Penman Modification Method**

| No. | Description | Unit | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 20 | ETo = ETo* x c | Mm /hari | 1.425 | 1.459 | 1.303 | 1.267 | 1.225 | 1.115 | 1.189 | 1.643 | 1.960 | 1.673 | 1.334 | 1.328 |

C. WATER AVAILABILITY OF TIDAL DISCHARGE

Analysis of water availability of tidal discharge

| | |
|---|---|
| Average land elevation | +8.5 m |
| Measured discharge in the field | 8.01 $m^3/s$ |
| The effective time of tide level on the land | 3.5 hour/day |
| The effective volume of tide on the land | 100,975.30 $m^3$/day |
| Effective tide discharge (conversion of volume) | 1.17 $m^3/s$ ≈ 1168.7 liter/s |

D. PLANTING PATTERN

The proposed planting pattern is rice-rice-corn. In this study, simulations were carried out from November I to January I with the consideration that the period was the wet season with the lowest water requirements, so that the beginning of planting in December II was chosen. MT1 (rice) started from December to March, then MT2 (rice) started from April to July, while MT3 (corn) started from August to November.

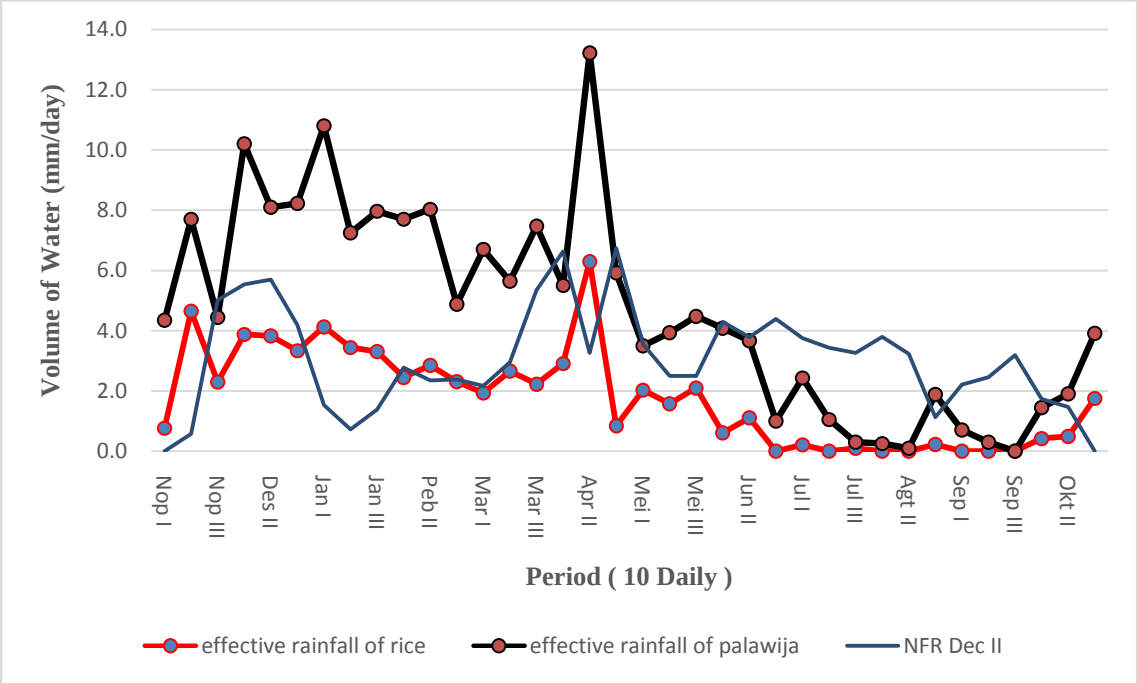


**Fig.2.Relationship of Effective Rainfall of Rice and Secondary Crop with the NFR at the Beginning of Planting in December II**

E. OPTIMIZATION

Optimization of wetland management was carried out using goal programming with the QM for Win tool on the results of the analysis of land water balance obtained by effective planting patterns and existing planting patterns applied by farmers. As a basis for optimization, the following farm data are presented at the research location including the production capacity per hectare of local rice, superior rice and secondary crop/ corn.

**Table 2 Value of farming in Wanaraya Sub-district**

| Commodity | Production (ton/ha) | Price (Rp/ton) |
|---|---|---|
| **Local rice** | 4,2 | Rp. 4.000.000,- |
| **Superior rice** | 8,4 | Rp. 2.800.000,- |
| **Corn** | 3,8 | Rp. 7.000.000,- |

**1. Mathematics Model**

This linear program was made according to the objective function to be achieved with the following constraint function variables:

a) Land area constraints
The area of 2480 ha was the current area of land use while the area of existing paddy fields was 2010 ha and the plantation area were 470 ha.

b) Water availability constraints
The function of constraints in this study was the availability of water of tidal discharge which was a fixed variable that was equal to 1168.7 l/sec at each planting period.

**2. Optimization Results**

The result of linear programming optimization with the QM for Win tool showed the optimal area for rice field (X1) = 1498 ha while the palawija area remained 470 ha. Optimization results can be seen as follows:

a) The planting pattern proposed which was rice-rice-secondary crop turned out to get insufficient water supply to irrigate the existing 2010 ha of rice fields. The area which was able to be irrigated was 1498 ha. Whereas the area of secondary crop could still be fulfilled with the available water.

b) In terms of the value of farming, it can be calculated the comparison of existing conditions and the proposed Planting Pattern:

$$\begin{aligned} Existing &= field\ area \times production\ capacity \times selling\ price \\ &= 2010 \times 4{,}2 \times 4.000.000 \\ &= Rp\ 2.814.000{,}000{,}- \\ Optimization &= field\ area \times production\ capacity \times selling\ price \\ &= 1498{,}33 \times 8{,}4 \times 2.800.000 \\ &= Rp\ 2.936.728.800{,}- \end{aligned}$$

From the calculation above, it is found that the extent of optimization results is still more favorable than existing conditions. For secondary crops, because the extent of optimization results is the same as the existing ones, then they are not counted in this comparison.

## IV. CONCLUSION

Based on the analysis of 10 daily rainfall data, hydro climatology and planting patterns from November I to January I, respectively, showed that the maximum water demand in the rice fields per period was 8.8 mm / day (Nov. I); 8.7 mm / day (Nov. II); 7.4 mm / day (Nov. III); 7.3 mm / day (Dec I); 6.7 mm / day (Dec II); 8.7 mm / day (Dec III); 8.7 mm / day (Jan I). The next December II period was used as the basis for determining the start of MT-I planting because it had the smallest value among the others.

From the results of the optimization of the linear programming method for the planting pattern of rice-rice-secondary crop, the optimal area for rice field was 1498 ha, while the area for the secondary crop remained the current condition, which was 470 ha. This optimization also showed the potential for an increase in farmer's income to Rp 2,936,726,800 from the estimated current condition of Rp 2,814,000,000.

## REFERENCES


[1]. Adhi, W. 2000. Mengelola dan Mengembangkan Rawa. Puslitannak. Bogor.
[2]. Alihamsyah,T. 2002. Prospek Kembangkan dan Manfaatkan Lahan Pasut dalam Pertumbuhan Pertanian Masa Depan. pp: 1-18.
[3]. Ayu, I.E., Sugeng, P dan Soemarno.2013. Mengevaluasi Ketersediaan Air Terhadap Lahan Kering di Kec. Unter Iwes, Sumbawa Besar.
[4]. BPS Kabupaten Batola. 2017. Kecamatan Dalam Angka 2017. BPS Kabupaten Batola. Marabahan.
[5]. Irianto, G. 2006. Pengelolaan Air serta Kebijakannya mengembangkan Lahan Rawa Lebak. Makalah Seminar Nasional. Departemen Pertanian.
[6]. Karnadi. 2012. Mengkaji Pola Tanam Lahan Gambut Kec. Sungai Raya Kab. Kubu Raya (Studi Kasus Desa Limbung).
[7]. Nasir, A.N dan S. Effendy. 1999. Menentukan Pola Tanam dengan Konsep Neraca Air.
[8]. Noor, M. 2007. Rawa Lebak: Ekologi, Manfaat dan Pengembangannya. PT Raja Grafindo Persada. Jakarta.
[9]. PT. Deka Pentra. 2018. Review Desain Daerah Rawa Sei. Seluang Kabupaten Barito Kuala. Laporan Akhir. Banjarmasin.
[10]. Putri, F.T. 2014. Mengoptimalisasi Pengelolaan Lahan Rawa Lebak Pematang dengan Pola Tata Tanam di Ogan Keramasan Sumatera Selatan.

[11]. Sa'ad, A. 1999. Mementukan Pola dan Waktu Tanam Berdasarkan Kesesuaian Lahan dan Analisis Neraca Air pada SUB DAS Bancak, DAS Tuntang Hulu Jawa Tengah.
[12]. Saleh, E., C. Irsan dan M.U. Harun. 2013. Mengevaluasi Pola Tanam pada Lahan Rawa Lebak Dangkal Ogan Keramasan. Laporan Penelitian. Universitas Sriwijaya. Indralaya.
[13]. Suripin. 2002. Mempelestarikan Sumber Daya Tanah Dan Air. PT. Andi. Yogyakarta
[14]. Triatmodjo, B. 2010. Hidrologi Terapan/Applied Hydrology. Beta Offset. Yogyakarta
[15]. Waluyo. 2000. Menentukan Masa dan Pola Tanam Padi dan Kedelai pada Kondisi Air Rawa Lebak di Daerah Kayu Agung (OKI) Sumatera Selatan.
[16]. Wirosoedarmo, R and U. Apriadi. 2010. Studi Perencanaan Pola Tanam dan Pola Operasi Pintu Air Jaringan Reklamasi Rawa Pulau Rimau di Kabupaten Musi Banyuasin Sumatera Selatan. Jurnal Teknologi Pertanian, 3 (1):56-66

Muhammad Kafid Maskuri" Optimizing Planting Patterns in Sei Seluang Wetland Irrigation Area Barito Kuala Regency" American Journal of Engineering Research (AJER), vol. 8, no. 10, 2019, pp 123-127