



# Determinants of Production Risk in Cauliflower Farming Using the Just and Pope Production Function Model in Tanggamus Regency

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**Abstract:** Cauliflower is a horticultural commodity vulnerable to production risks caused by pest and disease infestations and climate change, along with risks inherent in the use of farming production factors. This crop is an emerging commodity in Tanggamus Regency, Lampung Province. The study aims to measure the magnitude of production risks, and determinants of production risk in cauliflower farming in Tanggamus Regency. The research was conducted in the Gunung Alip and Gisting districts, as they represent the sole areas of cauliflower cultivation in Tanggamus. Data were collected from 74 cauliflower farmers during the 2024 dry season, from January to August 2025. Production risk was measured using the coefficient of variation (CV). The determinants of production risk were analyzed using the Just and Pope production function approach. The findings indicate a coefficient of variation of 0.27, which signifies a low level of risk in cauliflower farming. Factors that significantly affect production include land area, seeds, NPK fertilizer, manure, and labor. Factors that significantly affect production include land area, seeds, NPK fertilizer, manure, and labor. Among the inputs, pesticide use increases production risk, whereas the use of seeds significantly reduces it.

**Keywords:** Cauliflower; Just and Pope; production factors; risk

## 1. INTRODUCTION

Horticulture plays a crucial role in efforts to diversify agricultural products, supporting the achievement of food security and enhancing farmer welfare through income generated from farming (Sriyadi, 2010). Various parties have provided ongoing support so that horticulture can become the main support for farmers' household income (Sapriyadi *et al.*, 2025). Tanggamus Regency has significant potential for horticultural development, particularly in cauliflower production. According to data from Statistics Indonesia (BPS), Tanggamus Regency has significant potential for horticultural development, particularly in cauliflower production (2024). The harvested area of cauliflower increased rapidly, from 33 hectares in 2021 to 113.25 hectares in 2024. This indicates a growing interest among farmers in growing cauliflower. This increase in interest is also driven by technological advances and the ease of obtaining seeds, which have been distributed throughout Tanggamus Regency, leading farmers to cultivate cauliflower (Putri *et al.*, 2025).

Planting cauliflower attracts the interest of farmers because of the fast harvest time of cauliflower, namely 45 days after planting (DAP), apart from that, this plant is economically profitable (Putri *et al.*, 2025). However, cauliflower, with its various problems, faces obstacles in increasing production, income, and improving farmer welfare. Cauliflower is often attacked by pests and diseases during seasonal changes, resulting in decreased productivity (Laksono, 2020). *Plutella* caterpillars are a major pest of cauliflower. Additionally, caper bugs also pose a threat to cauliflower plants. These tiny insects cause holes in cauliflower leaves.

Farmers often refer to them as little butterflies because of their resemblance to the insect's shape and size. Cauliflower plants are also susceptible to black rot disease (Fatimah *et al.*, 2022). The use of good input will affect the quantity and quality of production, so that risks can be minimized (Sasrido *et al.*, 2022).

Good input use includes the use of certified, high-yielding, pest-and-disease-resistant seeds, organic and inorganic fertilizers, pesticides to suppress pest and disease growth, and the most important input factor, labor. The combination of organic and inorganic fertilizers can maintain soil conditions, increase crop productivity, and make fertilizer use more efficient (Fahriyah *et al.*, 2021). Furthermore, the widespread use of inorganic fertilizers in small-scale farming has helped increase crop yields, supporting food security and economic growth (Pandian *et al.*, 2024).

Crop failure is an example of a form of risk that cauliflower farmers cannot avoid in running their farming operations. Risk is generally associated with the decision-making process, as it is defined as the probability of an adverse event occurring after an action is taken. The greater the level of uncertainty, the greater the potential risk inherent in each decision. Therefore, recognizing and identifying sources of risk is a crucial step in decision-making (Yardha *et al.*, 2021). Theoretically, farmers who are able to minimize production risks through increased productivity, business diversification, appropriate cropping patterns, strengthening farmer group institutions, and improving their bargaining power will be better able to drive increased production and income. Based on this, this study was conducted to measure

the magnitude of production risks, and determinants of production risk in cauliflower farming in Tanggamus Regency, Lampung Province.

**2. MATERIALS AND METHODS**

**2.1 Research Location**

Research on the risks of cauliflower farming was conducted in Tanggamus Regency, specifically in the Gunung Alip and Gisting sub-districts. In Tanggamus, cauliflower is only grown in these two sub-districts, spread across several villages. The population of cauliflower farmers in both sub-districts is 82. The respondents for this study were 74 cauliflower farmers who planted cauliflower during the dry season in 2024. Data collection was conducted from January to August 2025.

**2.2 Data Analysis Method**

Cauliflower farming production risk is estimated using the CV (coefficient of variation). The coefficient of variation is the ratio of the standard deviation ( $\sigma$ ) to the average production value ( $\bar{Y}$ ), thus determining the relative risk of production. A low CV value indicates low variability in the average production risk. Conversely, a high CV value indicates high variability in the average production risk. The formula for calculating the coefficient of variation is as follows.

$$CV = \frac{\text{Standard deviation } (\sigma)}{\text{The average production value } (\bar{Y})} \dots\dots\dots(1)$$

The analysis of the influence of production factors or the use of farm inputs on cauliflower production is determined using the Cobb-Douglas production function as follows:

$$\ln Y = \ln \beta_0 + \beta_1 \ln \text{LHN} + \beta_2 \ln \text{BN} + \beta_3 \ln \text{UR} + \beta_4 \ln \text{PN} + \beta_5 \ln \text{KD} + \beta_6 \ln \text{PS} + \beta_7 \ln \text{TK} + \varepsilon_1 \dots\dots\dots(2)$$

Furthermore, equation (2) is used to analyze the flow of production factor usage that influences production risk. The risk function analysis is carried out by regressing the residual value  $\varepsilon$  against the independent variable of production factor usage (Just and Pope, 1979).

$$\ln Y = \ln \beta_0 + \beta_1 \ln \text{LHN} + \beta_2 \ln \text{BN} + \beta_3 \ln \text{UR} + \beta_4 \ln \text{PN} + \beta_5 \ln \text{KD} + \beta_6 \ln \text{PS} + \beta_7 \ln \text{TK} + \varepsilon_1$$

$$(\varepsilon^2_1) = \ln \beta_0 + \beta_1 \ln \text{LHN} + \beta_2 \ln \text{BN} + \beta_3 \ln \text{UR} + \beta_4 \ln \text{PN} + \beta_5 \ln \text{KD} + \beta_6 \ln \text{PS} + \beta_7 \ln \text{TK} + \varepsilon_2 \dots\dots\dots(3)$$

$\varepsilon$  is the residual or error value  
 $(\varepsilon^2_1) = (Y_i - \hat{Y}_i)^2 \dots\dots\dots(4)$

Where:

- $Y_i$  = Cauliflower production (kg)
- $\beta_1 - \beta_7$  = Estimator parameter coefficients
- LHN = Land (ha)
- BN = Seed (g)
- UR = Urea fertilizer (kg)

- PN = NPK fertilizer(kg)
- KD = Manure (kg)
- PS = Pest (Gram of active ingredients)
- TK = Use of labor (HOK)
- $\beta_0$  = Intercept
- $\varepsilon_1$  dan  $\varepsilon_2$  = Error

**3. RESULTS AND DISCUSSIONS**

**3.1 Respondent Characteristics**

Cauliflower farmers in Tanggamus Regency are on average 46-47 years old. The majority of cauliflower farmers have a high school education. The number of family members ranges from 2 to 3 people. Cauliflower cultivation in this regency has been around for four years, so farmers have only about three to four years of experience cultivating cauliflower. The majority of farmers rent land for growing cauliflower, accounting for 62.16% of the land, with a rental price of IDR 2,000,000/ha/planting season. Farmers grow cauliflower on 0.55 hectares of land.

Cauliflower cultivation begins with seeding, requiring 117.89 grams of seed per hectare. Seedlings are ready to be planted in prepared land, fertilized with 227.89 kg of manure per hectare, and made into ridges. Seedlings are approximately 21-25 days after sowing (DAS). Fertilization is carried out one day after planting (DAP) with 415.47 kg of NPK fertilizer per hectare and 60.22 kg of urea per hectare. Pest and disease control is carried out one day after planting. The amount and type of pesticide used depend on the intensity of pest and weed attacks. Pests that attack cauliflower plants in Tanggamus are plutela caterpillars or small hanging caterpillars, armyworms, and kapper (small butterflies). These pests are controlled with Gracia and Ropea pesticides. In one planting season, farmers use pesticides equivalent to 640 grams of active ingredient (GBA/ha), with a frequency of application of 4-6 times per season. The average labor required for this cauliflower farming business is 272.67 people per hectare (HOK) with a wage of IDR 50,000 per HOK. Cauliflower can be planted 2-3 times a year. The average productivity of cauliflower is 10,326.70 kg/ha with a selling price of IDR 5,136.39/kg. When selling cauliflower, farmers are subject to a weight deduction or rafaction of approximately 10% of the cauliflower's weight. The amount of rafaction is influenced by the quality of the cauliflower. The income from cauliflower farming in the dry season of 2024 was IDR 28,592,570.77, and the R/C was 2.04: thus, cauliflower farming in the research area is profitable (Putri *et al.*, 2025).

The problem faced by farmers is that cauliflower productivity in Tanggamus Regency experiences an average decline of 21.48% during the rainy season due to pests and diseases. This condition poses a risk to cauliflower production, indicating challenges in the stability of harvest yields throughout the season. According to Kurniasih *et al.* (2023), the most critical perceived risk factor is climate/weather

change. From a social perspective, the majority (75.68%) have joined farmer groups. However, 66.22% of them admitted to never having participated in extension activities, so information and assistance related to cauliflower cultivation are very limited. Meanwhile, the average distance from a farmer's home to the land is 7 km, which generally takes approximately 14 minutes. This distance factor is still relatively affordable for farmers.

### 3.2 Production Risk

The average cauliflower production in the 2024 dry season was 10,326.70 kg/ha (Table 1). The table shows the standard deviation of cauliflower production at 2,790.79 kg. The CV (coefficient of variation) is 0.2703, or 27.03%. This value indicates a relatively low level of production variability. The high CV indicates a low level of distribution/instability of cauliflower production relative to the average. Previous research on cabbage also found that this commodity is considered safe or low risk (Mitra *et al.*, 2022). In addition, this study is also in line with Damayanti & Saputra (2018) and Mahmudah *et al.* (2012), who emphasized that a CV value below 0.5 reflects a low risk of farming production.

Table 1. Production risks of cauliflower farming in Tanggamus Regency

Description	Production Risk
Average production (kg)	10.326.7092
Standard deviation	2.790.7975
Coefficient variation (CV)	0.2703
CV (%)	27.03

Production risks in cauliflower farming generally arise from pest and disease attacks. These conditions can cause damage, such as stem rot and leaf loss due to caterpillar infestation. Another exacerbating factor is the cultivation practices of cauliflower farmers, who fail to rotate crops. Farmers grow cauliflower continuously without intercropping with other crops. This lack of crop rotation perpetuates the pest and disease cycle, leading to increased infestation rates. Research by Yu *et al.* (2022) found that crop rotation can effectively suppress high pest and disease incidence. Increasing pest intensity encourages farmers to spray pesticides more frequently. However, repeated pesticide use over the long term can actually lead to pest and disease resistance, reducing control effectiveness and maintaining high production risks (Sinambela, 2024).

### 3.3 Factors That Effect The Risk of Cauliflower Farming Production

Table 2 presents the results of the production function estimation and the risk function of cauliflower farming. The results of the production function model estimation indicate that the production factors that have a significant effect on cauliflower production are the variables LHN (land),

BN (seed), NP (NPK fertilizer), KD (manure), PS (pesticide), and TK (labor). The regression model is good, as indicated by the coefficient of determination (R<sup>2</sup>) value of 0.8998. Based on the results of the production function estimation in Table 2, the cauliflower production function can be written with the following equation.

Table 2. Estimation results of production function and production risk of cauliflower farming in Tanggamus Regency

Variabel	Production Function		Risk Function	
	Coeff	Prob	Coeff	Prob
Constant	6.8559	0.0000	-5.1472	0.2551
LHN (Land)	0.5188***	0.0000	0.3533	0.6721
BN (Seed)	0.1507***	0.0086	-1.9957***	0.0007
UR (Urea Fertiliezer)	0.0067	0.1976	0.0236	0.6556
PN (NPK fertilizer)	0.0814**	0.0422	0.1949	0.6262
KD (Manure)	-0.0105**	0.0506	-0.0384	0.4757
PS (Pest)	0.0135	0.7024	0.9189**	0.0122
TK (Use of labor)	0.1863***	0.0005	-0.0147	0.9771
R <sup>2</sup>	0.8998		0.3048	
Adjusted R <sup>2</sup>	0.8892		0.2311	
F-stat	84.7133		4.1346	
Prob(F-stat)	0.0000		0.0008	

Where: \*\*\*) Signifikan at α 0,01; \*\*) Signifikan at α 0,05; \*) Signifikan at α 0,1

$$\ln Y = 6.8559 + 0.5188 \ln LHN + 0.1507 \ln BN + 0.0067 \ln UR + 0.0814 \ln PN - 0.0105 \beta_5 \ln KD + 0.0135 \ln PS + 0.1863 \ln TK.. (5)$$

Table 2 also shows that only the seed and pesticide variables significantly influence production risk. The seed variable has a negative effect, while the pesticide variable has a positive effect. The risk function equation is as follows.

$$\ln \epsilon^2 = -5.1472 + 0.3533 \ln LHN - 1.9957 \ln BN + 0.0236 \ln UR + 0.1949 \ln PN - 0.0384 \beta_5 \ln KD + 0.9189 \ln PS - 0.0147 \ln TK.... (6)$$

The land area variable (LHN) has a significant positive effect at a 99 percent confidence level on cauliflower production in Tanggamus Regency. The regression coefficient is 0.5188, indicating production elasticity. A 1 percent increase in land area will increase cauliflower production by a regression coefficient of 0.1588 percent. This research aligns with (Zakirin *et al.*, 2014). Meanwhile, the cauliflower land area does not significantly influence cauliflower production risk.

The seed variable (BN) shows a positive and significant effect on production with a coefficient of 0.1507 and a probability of 0.0086. The more seeds used, the greater the increase in cauliflower production. If farmers add 1% of seeds, cauliflower production increases by 0.15%. Research (Widyastuti & Krestiani, 2022) aligns with this finding. Table 2 shows that the seed variable has a significant negative effect at the 99 percent significance level on production risk. In other words,

seed use can reduce production risk with a negative coefficient of -1.9957.

The UR variable or the use of urea fertilizer has no significant effect on either the production or the risk of cauliflower production. Tida & Wadu (2025) found the same thing as this study, namely that the urea variable has no significant effect on production. The PN variable (NPK fertilizer) has a significant effect at the 95% significance level and is positive on cauliflower production, with a coefficient of 0.0814. The addition of NPK fertilizer can increase cauliflower production. However, in the risk function, NPK fertilizer does not have a significant effect. The use of NPK fertilizer only plays a role in increasing production, but has no significant impact on production risk. Research by Yohana *et al.* (2025) and (Salam *et al.*, 2022) found something different from this study. Both researchers found that NPK fertilizer can increase production risk.

The manure variable (KD) has a negative coefficient of -0.0105 on the production function and has a significant effect at the 90% confidence level. However, the manure variable does not significantly influence cauliflower production risk. Manure takes a relatively longer time to decompose and provides nutrients to plants compared to chemical fertilizers, which is also one reason its effectiveness is less visible in the short term (Yohana *et al.*, 2025). Galla & Wadu (2025) research aligns with this study, indicating it has no effect on production risk.

The pesticide variable (PS) did not significantly impact cauliflower production, but had a significant effect at the 95% confidence level on cauliflower production risk. Studies (Pamusu *et al.*, 2019, and Zakaria *et al.*, 2023) indicate that pesticides significantly impact production. The positive effect of pesticides on risk indicates that pesticide use increases the risk of cauliflower production. Due to cauliflower pest attacks, farmers use high doses of pesticides. This indicates the potential negative impact of pesticide use on sustainable production.

The labor variable (BTK) has a significant positive effect on cauliflower production, with a coefficient of 0.1863 and a probability of 0.0005. Cauliflower cultivation requires meticulous care and a large workforce. Production can be increased by increasing the number of workers employed. A 1% increase in the number of workers results in a 0.19% increase in cauliflower production. This contrasts with research (Nurul *et al.*, 2018) that found labor had a significant negative effect on production. Meanwhile, the labor risk function has a negative coefficient of -0.0147 with a probability of 0.9771, indicating no significant effect on production risk.

#### 4. CONCLUSIONS

Cauliflower farming production risk in Tanggamus Regency is relatively low, as indicated by a coefficient of variation of 0.27. Production factors significantly influencing cauliflower production include farm size, seed use, NPK fertilizer, manure, and labor. Among these inputs,

pesticide use increases production risk, while seed use significantly reduces it. This study recommends reducing the use of risk-increasing inputs, particularly pesticides.

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#### REFERENCES

- Damayanti, Y., & Saputra, A. (2018). Analisis Penggunaan Input yang Mempengaruhi Produksi Usahatani Kentang di Kabupaten Merangin. *Seminar Nasional Pembangunan Pertanian Berkelanjutan Berbasis Sumber Daya Lokal*, 829–836. <http://conference.unja.ac.id/SemnasSDL/article/view/87>
- Fahriyah, F., Ula, M., & Salsabila, H. (2021). Studi Mitigasi Risiko untuk Meningkatkan Kinerja Subsistem Produksi Kentang di Kota Batu. *Jurnal Ekonomi Pertanian Dan Agribisnis*, 5(4), 1290–1300. <https://doi.org/10.21776/ub.jepa.2021.005.04.30>
- Fatimah, F., Khasanah, H. N., Khoirunnisa, R., Qurrotu'Aini, F., & Hanik, N. R. (2022). Identification of Diseases and Pests of Cauliflower (*Brassica oleracea*) in the Pedan Hamlet Plantation, Karanglo, Tawangmangu. *Jurnal Biologi Tropis*, 22(1), 113–120.
- Galla, N. M. P. A., & Wadu, J. (2025). Faktor-faktor yang Memengaruhi Risiko Produksi pada Usahatani Bawang Merah di Kecamatan Kampera Kabupaten Sumba Timur. *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 11(2), 2815. <https://doi.org/10.25157/ma.v11i2.18526>
- Kurniasih, D., Syaikat, Y., Nurmalina, R., & Suharno. (2023). Persepsi Petani terhadap Tingkat Kekritisn Risiko Usahatani Bawang Putih dan Strategi Manajemen Risikonya (Studi Kasus di Kabupaten Temanggung). *Jurnal Penyuluhan*, 19(02), 95–112. <https://doi.org/10.25015/19202346082>
- Laksono, R. A. (2020). Pengujian efektivitas jenis media tanam dan nutrisi terhadap produksi kubis bunga (*Brassica oleracea* L. var. *Botrytis*, subvar. *Cauliflora* DC) kultivar Mona F1 pada sistem hidroponik. *Kultivasi*, 19(1), 1030. <https://doi.org/10.24198/kultivasi.v19i1.23744>
- Mahmudah, Mahfudz, M., & Hindarti, S. (2012). Analisis Risiko Produksi Pada Usahatani Tomat Di Desa Tawangargo Kecamatan Karangploso Kabupaten Malang. *Jurnal Sosial Ekonomi Pertanian Dan Agribisnis*, 7(1), 1–7.

- Mitra, Y., Milla, A. N., & Tsani, A. (2022). Analisis Risiko Produksi dan Pendapatan Usahatani Kubis di Desa Pasir Datar Indah Kecamatan Caringin Kabupaten Sukabumi. *Agrikultura*, 33(3), 257. <https://doi.org/10.24198/agrikultura.v33i3.40560>
- Nurul, V., Mustajab, M. M., & Fahriyah. (2018). Analisis Efisiensi Alokatif Penggunaan Faktor-Faktor Produksi Pada Usahatani Padi (*Oryza Sativa* L.) (Studi Kasus Di Desa Puhjark, Kecamatan Plemahan, Kabupaten Kediri). *Jurnal Ekonomi Pertanian Dan Agribisnis*, 2(1), 10–18. <https://doi.org/10.21776/ub.jepa.2018.002.01.2>
- Pamusu, S. S., Harianto, Kuntjoro, & Winandi, R. (2019). Dampak Risiko Produksi Terhadap Kesejahteraan Rumahtangga Petani Bawang Merah di Kabupaten Sigi. *Jurnal Ekonomi Pertanian Dan Agribisnis*, 3(2), 429–438. <https://doi.org/10.21776/ub.jepa.2019.003.02.18>
- Pandian, K., Mustaffa, M. R. A. F., Mahalingam, G., Paramasivam, A., John Prince, A., Gajendiren, M., Rafiqi Mohammad, A. R., & Varanasi, S. T. (2024). Synergistic Conservation Approaches for Nurturing Soil, Food Security and Human Health Towards Sustainable Development Goals. *Journal of Hazardous Materials Advances*, 16(June), 100479. <https://doi.org/10.1016/j.hazadv.2024.100479>
- Putri, R. D., Prasmatiw, F. E., & Haryono, D. (2025). Pendapatan Usahatani Kembang Kol Musim Kemarau dan Musim Hujan di Kabupaten Tanggamus. *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 11(2), 3376–3384. <https://doi.org/10.25157/ma.v11i2.19061>
- Salam, M., Amir, N. S., Viantika, N. M., & Fudjaja, L. (2022). Analisis pendapatan dan faktor-faktor yang mempengaruhi produksi usahatani jagung hibrida. *Agromix*, 13(2), 248–260. <https://doi.org/10.35891/agx.v13i2.3170>
- Sapriyadi, Ambar, A. A., & Toaha, S. (2025). Strategi Pengembangan dan Peningkatan Produksi Sektor Basis pada Tanaman Hortikultura di Kabupaten Sidenreng Rappang. 36(1), 115–127.
- Sasrido, M., Tanjung, F., & Mutiara, V. I. (2022). Analisis Preferensi Risiko Petani Pada Usahatani Gambir Di Kabupaten Pesisir Selatan. *Jurnal Agriuma*, 4(2), 78–87. <https://doi.org/10.31289/agri.v4i2.7940>
- Sinambela, B. R. (2024). Dampak Penggunaan Pestisida Dalam Kegiatan Pertanian Terhadap Lingkungan Hidup Dan Kesehatan. *AGROTEK: Jurnal Ilmiah Ilmu Pertanian*, 8(1), 76–85. <https://doi.org/10.33096/agrotek.v8i1.478>
- Sriyadi. (2010). Risiko Produksi dan Keefesienan Relatif Usahatani Bawang Putih di Kabupaten Karanganyar. *Jurnal Pembangunan Perdesaaan*, 10(2), 69–76.
- Tida, F. M., & Wadu, D. J. (2025). Analisis Risiko Usahatani Padi Sawah di Kelurahan Lambanapu Kecamatan Kampera Kabupaten Sumba Timur. *SATI: Sustainable Agricultural Technology Innovation*, 485–498.
- Widyastuti, W., & Krestiani, V. (2022). Faktor-Faktor Yang Mempengaruhi Produksi Padi Organik Di Kecamatan Batang Anai Kabupaten Padang Pariaman. *Jurnal Agroteknologi Pertanian & Publikasi Riset Ilmiah*, 4(2), 46–56. <https://doi.org/10.55542/jappri.v4i2.537>
- Yardha, Wahyudi, E., & Wafi, A. (2021). Analysis on Factors Affecting the Risk of Rice Farming Production in West Tanjung Jabung Regency. *IOP Conference Series: Earth and Environmental Science*, 715(1). <https://doi.org/10.1088/1755-1315/715/1/012009>
- Yohana, Y., Fitrianti, W., & Suharyani, A. (2025). Risiko Produksi Usahatani Padi Sawah Varietas Unggul di Kecamatan Sandai Kabupaten Ketapang. *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 11(1), 686. <https://doi.org/10.25157/ma.v11i1.16263>
- Yu, T., Mahe, L., Li, Y., Wei, X., Deng, X., & Zhang, D. (2022). Benefits of Crop Rotation on Climate Resilience and Its Prospects in China. *Agronomy*, 12(2), 1–18. <https://doi.org/10.3390/agronomy12020436>
- Zakirin, M., Yurisinthae, E., & Kusriani, N. (2014). Analisis Risiko Usahatani Padi Pada Lahan Pasang Surut Di Kabupaten Pontianak. *Jurnal Social Economic of Agriculture*, 2(1), 75–84. <https://doi.org/10.26418/j.sea.v2i1.5122>