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Effect of Planting Time against Indonesian Soybean Production

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Abstract: From previous research (Nelly, et al, 2016) found one of the independent variables, namely (X5) Land and Intensification with 4 indicators. This paper is one of the results of research that applies the second indicator, namely planting throughout the year. In this study the researchers applied planting time in June, July and August. It is hoped that cultivation at this time of planting can also produce the amount of production that is in accordance with the profile of the type of soybean used and which produces soybeans with quality appearance, color and shape, such as imported soybeans that are preferred by consumers of the tempeh industry and especially tempeh chips.

Analysis of the data in this study using experimental design theory using a Complete Randomized Block design with Sub-Sampling. The treatment is planting time with a sampling block of 5 types of Indonesian soybean seeds. From the results of the analysis using a 5% confidence level, it was concluded that it was not significant, meaning that the yield/production was not affected by the planting time. Farmers are advised to plant throughout the year, every month using superior seeds so that soybean needs can be met.

Keywords: planting time, type of seed, soybean production, analysis of variance

Introduction

This research is a continuation of previous research, namely grants in 2018, 2019 and 2020, is a verification of research in 2016. The results of research in 2016 researchers found a strategy model to overcome inventory problems for Indonesian soybean commodity (domestic production). The Strategy Model of Domestic Production Soybean Inventory to Achieving Self-Funding as a novelty for researchers consisting of 4 independent variables and 2 dependent variables with 32 indicators. Each indicator needs to be tested by conducting further research so that farmers or people who care about soybeans can prove the truth of the indicators. This research is to examine and analyze other indicators from the independent variable (X5) namely Land and Intensification with indicators namely: 1) Intercropping at least 2 types of plants, 2) Planting throughout the year, 3) Utilization of abandoned land and 4) Utilization Perhutani (State -Owned Enterprises in the form of hardy plant cultivation) land, Garden land and other lands (Nelly, et al, 2019). In this study, indicator 2 is applied, namely planting throughout the year.

Theoritical Review

Efforts to increase soybean production One of the efforts to empower the community is to carry out a productive economic activity. For farming communities, among others, they can increase their productivity by cultivating soybeans as an alternative (Dogbe, W., et al, 2013). The high demand for soybean commodities requires a sustainable approach so that soybean production can increase significantly (J.M. Mahasi, et al, 2011). Breeding needs to be done so that resistance to disease in soybeans can be maintained (F.S.C. Hassan, 2014). A strategy is needed to increase soybean production in Indonesia (Nelly B, et al, 2016). Many factors affect soybean production, including varieties, land conditions and planting time (Nelly Budiharti and ING Wardana, 2018). To support the community, especially soybean farmers, to plant soybeans, it is necessary to make efforts to provide facilities and systems that can support the realization of increased productivity (Churi, A.J, et al, 2013). Increasing the time of planting, planting throughout the year, always planting national soybeans instead of alternating with rice or other crops such as tobacco so that they will become professional in cultivation is one of the important factors to increase soybean production (Nelly Budiharti and ING Wardana, 2018). The current condition is that farmers plant soybeans alternately with rice. Currently, soybean farmers only plant once a year, even though they can plant all year round by collaborating with eucalyptus plantations (Nelly B, et al, 2016).

Analysis of climate characteristics for optimizing soybean production, determining the location of soybean centers and the appropriate planting time period are very important in order to obtain maximum production (Nurhayati, et al. 2010).

Sub Sampling in Random Complete Block Design

In addition to completely randomized designs, the use of sub-sampling methods is also often used in completely randomized block designs. This observation was carried out on some experimental units.

In this random complete block design method, the mathematical model to be used with the same sub-sampling size can be written in the form:

$Yijk$=ì+âi+ði+åij+çijk

Where :

$Yijk$ = measured variable

i = general average

âi = block average effect to i

ði = average treatment effect to j

åij = experimental unit effect due to treatment to j in block i

cijk = the effect of the k^{th} sample taken from the experimental unit due to the j^{th} treatment in the i^{th} block

The form of a random complete block design with sub-sampling is as shown in table 1 below:

Table 1 Complete Random Block With Sub Sampling

Block		Treatment				J_{io}	Y_{io}
		1	2		k		
1	1 2 M	Y_{111} Y_{112} Y_{11m}	Y_{121} Y_{122} Y_{12m}		Y_{1k1} Y_{1k2} Y_{1km}		
E_{ij}		J	J		J	J	Y_1
2	1 2 m	Y_{211} Y_{212} Y_{21m}	Y_{221} Y_{222} Y_{23m}		Y_{2k1} Y_{2k2} Y_{2km}		
E_{ij}		J	J		J	J	Y_2
3	1 2 m	Y_{311} Y_{312} Y_{31m}	Y_{321} Y_{322} Y_{32m}		Y_{3k1} Y_{3k2} Y_{3km}		
E_{ij}		J	J		J	J	Y_3
J		J_1	J_2		J_k		
Average		Y_1	Y_2		Y_k		Y_{io}

For the calculation of ANOVA from the Random Complete Block model using the sub sampling method, several calculations are needed as follows:

$$\sum Y^2 = \sum_{i=1}^{b} \sum_{j=1}^{p} \sum_{k=1}^{n} Y^2{}_{ijk}$$

Ry= J²/bpn

$$Sb = \sum_{i=1}^{b} \sum_{j=1}^{p} (J^2{}_{ij}/n) - R_y$$

Where : *Jij* = the total number of observations in the sub -sample of the experimental units found in block i and treatment to j

$$J_{ij}=\sum_{k=1} Y_{ijk}$$

$$S_y = \sum Y^2 - Ry - S_b dengan dk = bp(n-1)$$

$$By = \sum_{i=1}^{b} (J2^{io}/pn) - Ry dengan dk = (b-1)$$

$$Py = \sum_{J=1}^{p} (J^2{}_{oj}/bn) - Ry dengan dk = (p-1)$$

$$Ey = Sb - By - Py dengan dk = (b-1)(p-1)$$

Based on the calculations above, a list of ANOVA used for decision making can be made, as shown in the following table:

Table 2 ANAVA for Random Complete Block Design with Sub Sampling

Source of Variation	degrees of freedom	Sum of squares	Average Sum of squares	F Statistic
Average	1	Ry	R	
Block (Varietas)	b – 1	By	B	
Treatment (Time)	p – 1	Py	P	P/E
Error of Experiment	(b-1) (p-1)	Ey	E	
Error of sampling	Bp (n-1)	Sy	S	
Amount	bpn	ΣY^2		

In this model the zero hypothesis that can be tested is as follows: Ho : πj = j = 0 assume Σπj = 0 To test the hypothesis H_0 used statistics with F = P/E, if it turns out that the calculated F is greater than the distribution value of F in the table with $F\alpha(v1,v2)$ where v1=(p-1) and v2= (b-1)(p-1) and the selected significant level , then the H_0 will be rejected. On the other hand, if the calculated F is smaller than the F in the table, then H_0 will be accepted.

The data required for ANAVA are:

Results Analysis

Table 3. Yield of each subplot (Ounces) for every 10 meters squared

Treatment		Soybean seeds (Block)					J_{io}	$\overline{Y}_{i0}$
		1	2	3	4	5		
June	1	95	102	123	57	67		
	2	90	88	101	46	72		
	3	89	109	113	38	66		
J_{1j}		274	299	337	141	205	1.256	83,7
July	1	92	96	93	37	54		
	2	89	99	110	40	68		
	3	106	107	115	35	64		
J_{2j}		287	302	318	112	186	1.205	80,3
August	1	91	102	112	39	57		
	2	82	93	104	39	61		
	3	98	98	110	47	63		
J_{3j}		271	293	326	125	181	1.196	79,7
J_{oj}		832	894	981	378	572	J=3.657	Y_{oo}=81,27
Y_{oj}		92,4	99,3	109	42	63,6		

$\sum Y^2 = 95^2 + 90^2 + \cdots + 61^2 + 63^2 = 326.819$

$$Ry = \frac{(3.657)^2}{3x5x3} = 297.192{,}2$$

$$Sb = \frac{(274)^2 + (299)^2 + \cdots + (181)^2}{3} - 297.192{,}2 = 28.054{,}8$$

$$Sy = 326.819 - 297.192{,}2 - 28.054{,}8 = 1.572$$

$$Wy = \frac{(1.256)^2 + (1.205)^2 + (1.196)^2}{5 \text{ X } 3} - 297.192{,}2 = 139{,}6$$

$$By = \frac{(832)^2 + (894)^2 + (981)^2 + (378)^2 + (572)}{3 \text{ x}3} - 297.192{,}2 = 27.684{,}4$$

$$Ey = 28.054{,}8 - 139{,}6 - 27.684{,}4 = 230$$

Table 4. ANOVA Table for the Effect of Time on Production Results

Source of Variation	Degrees of freedom	Sum of squares	Average Sum of squares	F statistics
Average	1	297.192,2	297.192	
Block (Varietas)	4	27.684,4	6.921	
Treatment (Time)	2	139,6	69,8	2,41
Error of Experiment	8	230,8	28,9	
Error of sampling	30	1.572	52,4	
Amount	45	329.819		

From table 4 with a 95% confidence level, the F table value can be obtained 0.95 ; (2.8) = 4.46 > 2.41 (F statistic). It can be concluded that the time planting does not affect the yield. From this research by using analysis of experimental design theory with random block sub-sampling design, the treatment applies to other treatments. This means that for all planting times, for 12 months in 1 year, farmers can plant. The planting time for various soybean varieties will produce the amount of production according to the profile of the variety used. From the results of this study, farmers are advised to choose high-yielding varieties, both from the amount of production produced and the quality of appearance.

Conclusion

1. Planting time does not affect the yield obtained.
2. The difference in production results obtained cause of each variety has its own profile.
3. The yield for each variety has a lower and upper limit according to the profile found by the breeder (variety inventor)

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