

# Analysis of Variance Using Three Factor Experimental Design with a Fixed and Random Model for Indonesian Soybean Production

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**Abstract---** This research is conducted to find out the results obtained by looking at the effect of the use of superior seed type, planting location and planting time. Processing and data analysis using experimental design is 3 factorial designs with fixed model and random model with 95% of confidence level. The experiment is conducted using 3 types of superior seedlings planted in 2 districts in Malang, East Java province with 3 times planting. The result of the study shows that there was strong effect for seed type but there weren't effect for planting location and planting time on production yield. There weren't effect for interaction actually BC (Planting Location and Planting Time) interaction, but just a little and not to seed type.

**Keywords---** Superior Seed Indonesian Soybean, Planting Location, Planting Time, Interaction, Production.

## I. Introduction

The government efforts to be self-sufficient again in 2014 are still not reached (Nelly, et al, 2017). Through the National Medium Term Development Plan (RPJMN) stage III (2015 - 2019) it is expected that self-sufficiency of soybean can be achieved (Nelly, et al, 2016).

There were 3 approaches to increase domestic soybean production, such as increasing cropping intensity, planting area expansion and increasing productivity (Suyanto and I.N. Widiarta, 2011).

The biggest domestic soybean suppliers from East Java province were Jember and Banyuwangi (Central Bureau of Statistics, 2013). Planting in Jember district was done once a year; it was in June, whereas, in Banyuwangi regency it was done twice a year those are June and December, (Nelly, et al, 2016).

The use of superior seeds and planting all year around will increase productivity (Nelly, et al, 2016). Both utilizing the 98 % of abandoned land and the state owned company of agriculture and forestry land, plantation as well as other land of 99% will increase the production, (Nelly, et al, Through this research it is expected to know the yield obtained by applying several varieties of superior seeds and planting location as well as the planting time.

## II. Research Method

The research was conducted by the experiment of applying 3 types of superior seedlings applied in 2 sub districts in Malang Regency, East Java Province, Indonesia with 3 planting times.

Processing and data analysis used experimental design. The experimental design used was in accordance with the treatment performed. In this case, 3 factors of factorial design with fixed model and random model. There have been many varieties found in the soybean cultivation of domestic production.

Since it is a random model, it means that the conclusion applies not only to the 3 types of tested seeds but also to all varieties of other soybean domestic production.

Likewise for the location of planting; not only applies to these 3 locations but also to other locations. Henceforth, it paid the expectation to reduce the deficit.

### III. Result and Discussion

By planting soybean domestic production in accordance with the theory and guidance of soybean research and development unit, agriculture department especially food crops, Jember regency, East Java province, Indonesia, BBPP 2015 (Agricultural Training Center) Ketindan, Djoko Sumianto, Soybean Agriculture business Technical Training, the production of the experiment done are as follow:

Table 1: The Production Result of the Treatment of 3 Indonesian Soybean Varieties, 2 Planting Locations and 3 Planting Times (Ton/ha)

	DENA 1 (A1)		DEGA 1 (A2)		GROBOGAN (A3)	
	Tumpang (B1)	Singosari (B2)	Tumpang (B1)	Singosari (B2)	Tumpang (B1)	Singosari (B2)
JANUARY C1	2.2	2.7	3	2.8	3.2	2.8
	2.5	2.5	2.9	3.4	2.9	3
	2.4	2.3	3.4	3.2	2.8	2.9
Sum	7.1	7.5	9.3	9.4	8.9	8.7
FEBUARY C2	2.1	2.7	2.8	3	2.8	3.2
	2.4	2.4	2.8	3.4	2.8	2.9
	2.3	2.6	2.9	3.3	3	3.1
Sum	6.8	7.7	8.5	9.7	8.6	9.2
MARCH C3	2.2	2.3	3.4	3	3.2	3.2
	2.4	2.5	3.2	2.9	3	2.9
	2.5	2.4	3.9	3.4	2.4	2.8
Sum	7.1	7.1	9.5	9.3	9.1	8.9
TOTAL	21	22.2	27.3	28.4	26.6	26.8

Hypothesis:

$$\text{Variant: } (\sigma^2 A) = 0; (\sigma^2 B) = 0; (\sigma^2 C) = 0$$

$$(\sigma^2 AB) = 0; (\sigma^2 AC) = 0; (\sigma^2 BC) = 0; (\sigma^2 ABC) = 0$$

Conclusion: There are no different variant for varieties, planting location, planting time, interaction A and B, A and C, B and C, A and B and C to production results.

Table 2: Analysis of Variance

Source of variation	df	SS	MS	Fratio	Ftable*)
Seed Type (Ai)	2	7,90	3,95	82,674	3,266
Plant Location (Bj)	1	0,09	0,09	1,876	4,116
Planting Time (Ck)	2	0,03	0,02	0,360	3,266
(AxB) Interaction ABij	2	0,05	0,02	0,492	3,266
(AxC) Interaction ACik	4	0,20	0,05	1,070	2,642
(BxC) Interaction BCjk	2	0,36	0,18	3,725	3,266
(AxBxC) Interaction ABCijk	4	0,23	0,06	1,225	2,642
SSE	36	1,72	0,05		
SST	53	7,90			

Table 2 anova it can be seen that:

1. There was strong effect for seed type but there weren't effect for planting location and planting time on production yield.
2. There weren't effect for interaction actually BC interaction, but just a little and not to seed type.

We can look result of the experiment, on Figure 1.

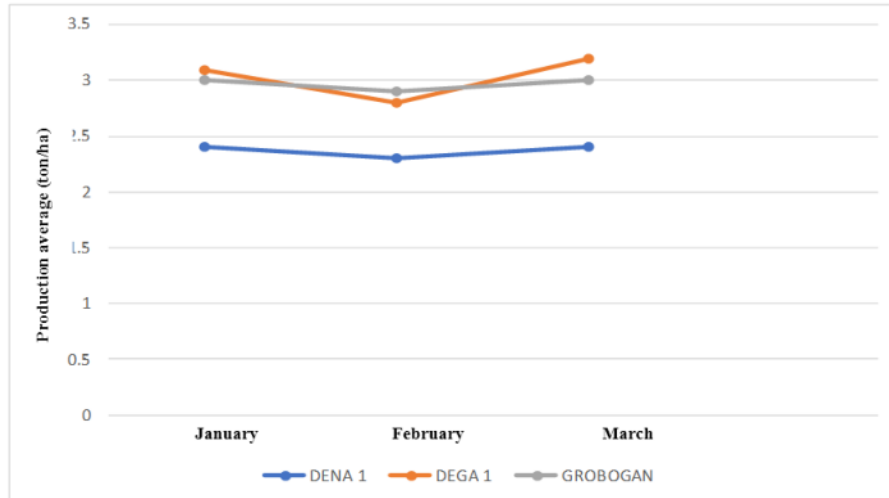


Figure 1: The Average Production Yield (Tons/Acre) in Tumpang Sub-District (the Grobogon Seed Type Produce Higher and Stable)

As it is shown in figure 2, the Grobogon Seed type produce higher and stable production yield in Tumpang Sub-district.

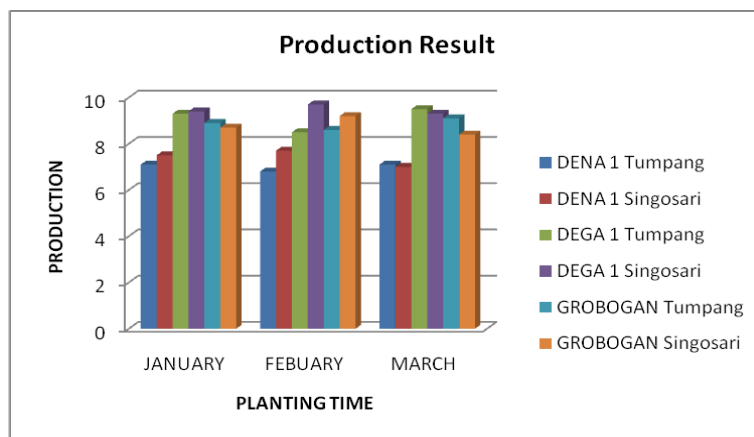


Figure 2: The Grobogon Seed Type Produce Higher and Stable Production Yield in Tumpang Sub-district

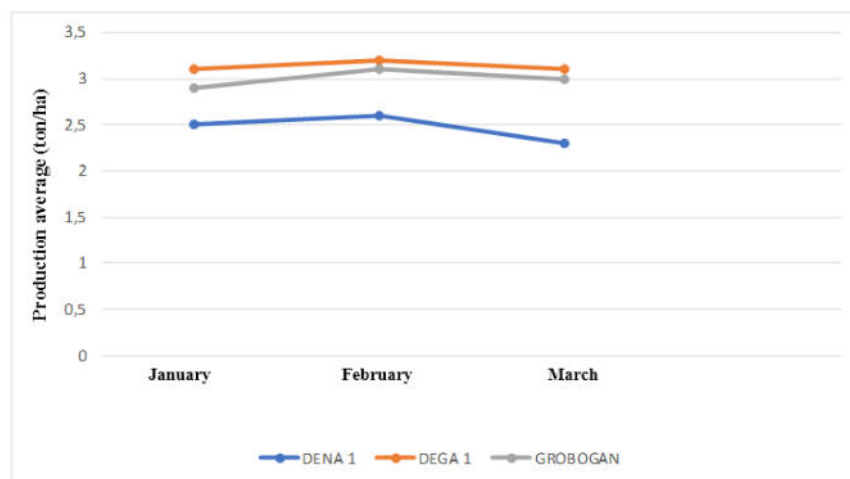


Figure 3: The Average Production Yield (Tons/acre) in Singosari Sub-District (the Dega 1 Seed Type Produce Higher and Stable)

As shown in Figure 4, the Dega 1 Seed type produce higher and stable production yield in Singosari Sub-district.

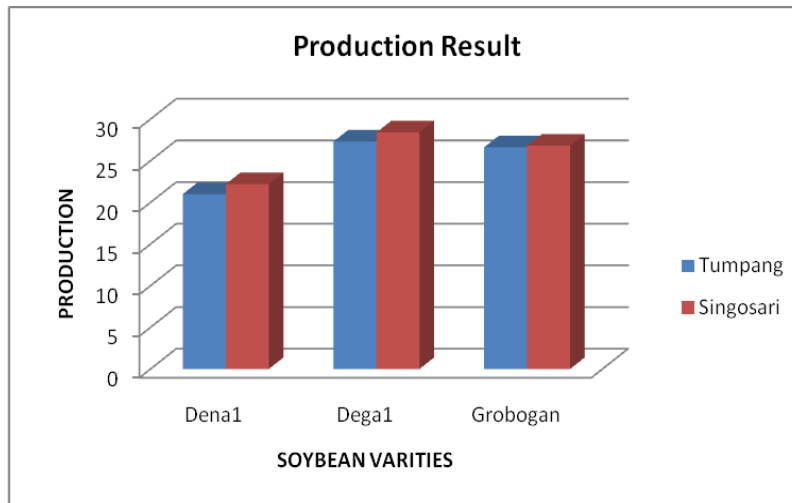


Figure 4: The Dega 1 Seed Type Produce Higher and Stable Production Yield in Singosari Sub-district

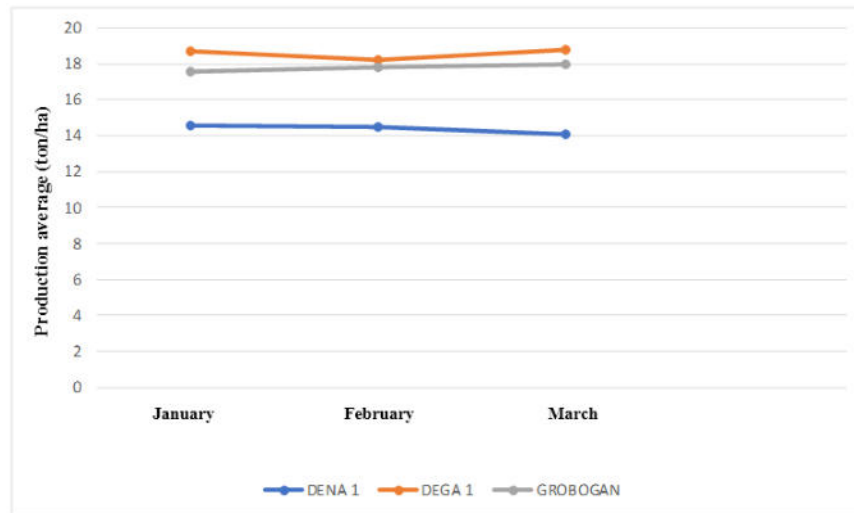


Figure 5: The Average Production Yield (Tons/acre) in 3 Planting Time (the Dega 1 Seed Type Produce Higher and Stable)

As it is shown in Figure 6, the Dega 1 Seed type produce higher and stable production yield in 3 Planting Times Tumpang Sub-district.

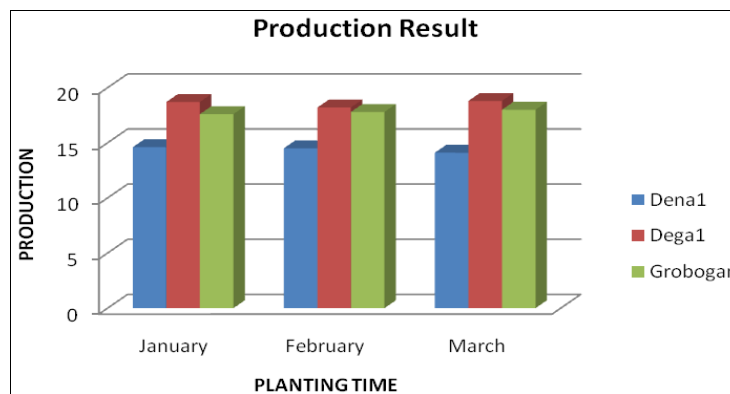


Figure 6: The Dega 1 Seed Type Produce Higher and Stable Production Yield in Tumpang Sub-district

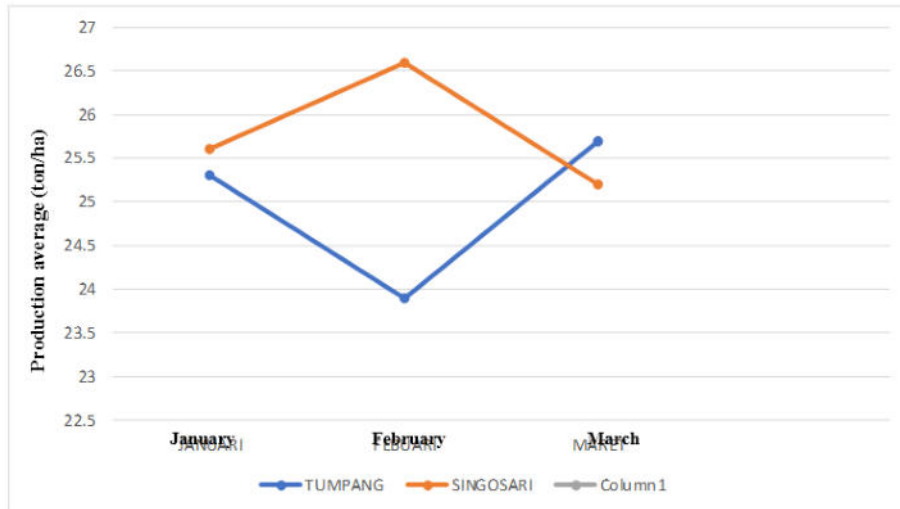


Figure 7: The Average Production Yield (Tons/acre) in 2 Planting Location, Singosari give Higher Production then Tumpang

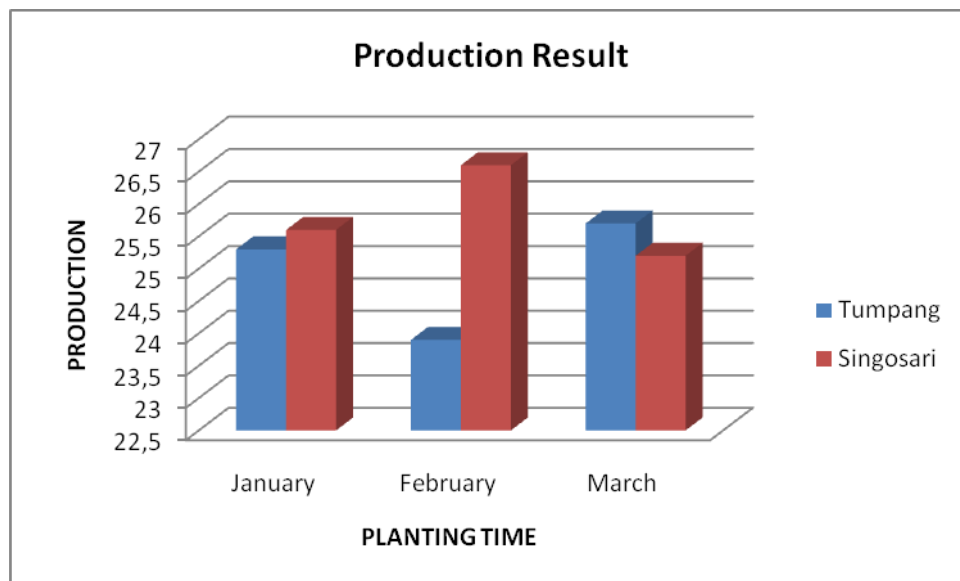


Figure 8: The Average Production Yield (Tons/acre) in 2 Planting Location, Singosari Produce Higher and Stable Production

As shown in Figure7 and 8, In Tumpang, it produced higher production yield on March planting time. Whereas, in Singosari it produced higher production yield on all Planting time.

#### IV. Conclusion

Based on the research result, it can be concluded from this research as follow:

1. There was strong effect for seed type but there weren't effect for planting location and planting time on production yield.
2. There weren't effect interactions of Seed type Indonesian soybean and Planting location (AB), Seed type and planting time (AC) and Seed type, Planting location and planting time (ABC) on the production yield. Actually BC (Planting Location and Planting Time) interaction, but just a little and not to seed type.
3. The Dega 1 seed type produced higher production yield (3, 1 ton/ acre in average) in 3 planting Time.

4. The Planting location in Singosari Sub-District for 3 varieties, produced higher production yield that was 77, 4 tons/acre, compared to tumpang Sub-District that was 74, 9 tons/acre.
5. In Tumpang sub-district for 3 varieties. The higher production was on March Planting time. (25, 7 ton/acre) while in Singosari Sub-district lasted on February Planting time (26.6 ton/acre).

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