Individual Selection Soybean (Glycine max L.) The Genotype of Cross Argomulyo and Tanggamus Based on Character of Yield Component

Arvita Netti Sihaloho, Wahyunita Sitinjak and Tioner Purba
Agriculture Faculty, Simalungun University.

* netti.haloho@gmail.com

Abstract. Selection is one of plant breeding techniques to obtain a desired character. The objective of this research was to determine information about the trait variance in F3 lines in terms of yield and yield components, knowing character could be improved through selection to obtain high yield lines. This study was conducted on June until August 2020 in the village Karang Bangun Rambung Merah Kecamatan Pematangsiantar, kabupaten Simalungun 500-550 with an elevation place, use augmented design. 20 x 30 cm plant distance, data observed for each individual plant, and done to find genetic variance, environment variance, phenotypic variance, GCV, broad-sense heritability and Coefficient correlation. The result show that the value of heritability all character was moderate until high except the days of harvest was low. The value of GCV was narrow to the days to flowering and harvest, while other character value of the GCV was moderate until broad. Coefficient correlation indicated that Seed weight per plant was positively and significantly correlated with all studied traits except the days to flowering was negative and non-significant. Based on high heritability and broad GCV, selection process on seed weight per plant so 10 selected lines with highest seed weight.

1. Introduction
Soybean crop is nuts highly favored by the people of Indonesia as the ingredients for the food, tempe, tahu, and soy sauce. Soybeans are in almost all the territory of Indonesia, but had not yet been optimal soybean production. One way to increase production by the use of soybean superior varieties. Superior varieties obtained by doing a cross between parent who having different properties so that it can produce the desired superior character[1].

Superior varieties can be obtained through the activities of breeding by doing in the selection on germ plasm which has been available or by segregation population selection. The development of varieties soybean directed for the repair of productivity and the quality and adaptation to the special environment[2].

Selection is one of the stages of important in the program for the improvement varieties are the level of success depends on the variation that is inherited genetically, yield character components of soybean become the indicator of the yield and have been used as the selection criteria not direct to develop a high yield varieties[3].

The availability of high diversity on characters repaired and inherited toprogeni’s are an indication of success of the program. The genetic variation within a population is one important prerequisite determine the success of improved varieties soybean[4].
The yield component character in soy is an important character as an indicator of its results and has often been used as indirect selection in order to develop high yield varieties. The diversity of the components needed to select the best character to be the selection criteria or character of being allowed to be fixed.

Said that yield component character as the number branches per plant, the number pods per plants and weight 100 seeds can be used in the breeding program to select high yield genotype. The purpose of this research is to get information about the diversity of yield component and yield characters of F3 lines, knowing character selection could be improved through in order to obtain high yield lines [5].

2. Methods
This study was conducted on June until August 2020 in the village Karang Bangun Rambung Merah Kecamatan Pematangsiantar, kabupaten Simalungun 500-550 with an elevation place, use augmented design. 20 x 30 cm plant distance, F3 lines were 300 plants and the both of parents were 100 plants respectively, by 3 replication. Fertilizing done at the time when planting by 50 kg urea, 100 kg SP36, and 75 kg KCl per acre. Covering the irrigation system, plant maintenance weeding, pest control and disease do optimally according to needs.

Data observed for each individual plant, and done to find genetic variance, environment variance, phenotypic variance, Genetic Coefficient Variance (GCV), broad-sense heritability and Coefficient correlation. Criteria of broad heritability according to Mc.Whirter (1979) in [1], under the following condition: H < 0.20 = low, 0.20 < H > 0.50 = medium, H > 0.50 = high, while criteria of Genetic Coefficient Variance (GCV) according to Knight (1979): 0-10% named narrow, 10-20% named medium and > 20% named broad. The observation is done by measuring height plant, the days of flowering, the number of productive branch, the days of harvest, the number of pods per plant, seed weight per plant and weight 100 seeds.

3. Results and Discussion
Based on the results of its research it can be seen that there are genetic diversity the phenotype and the increasing on characters height plant, the number of pods and seeds weight per plant (Table 1). This shows that the selection of can be achieved because of the population has a broad genetic diversity. The breadth of the value of the differences that produced, good genetic diversity the phenotype and shows that there is a big chance to select the properties of desired. The differences that wider at variety of its genotype and phenotype caused by the seeds are used is the seed F3 was still high levels of segregation [1].

| Characters                  | Phenotype Variance $\sigma^2_p$ | Genetic Variance $\sigma^2_G$ |
|-----------------------------|---------------------------------|-------------------------------|
| Height plant (cm)           | 21.55                           | 45.14                         |
| The days of flowering (day) | 2.24                            | 1.36                          |
| The number of branches (branch) | 2.98                        | 0.65                          |
| The number of pods (pod)    | 292.21                          | 198.16                        |
| The day of harvest (day)    | 2.86                            | 0.09                          |
| Seed weight per plant (g)   | 193.04                          | 132.58                        |
| weight 100 seed (g)         | 3.47                            | 1.24                          |

Genetic diversity wider opportunities selection affect the success the higher. Progressively individual in the population of the nature of the more high frequency genes desired, so the opportunity to get better via genotype more selection and, when narrow, genetic diversity so individuals in population tends to uniform, so selection to repair the trait of being less effective. Genetic diversity be
great when far lines related, approaching homosigot, and originated from a cross parents different genetic background[6].

Selection can be done if the selected character having high value of heritability because heritability can guide a trait is affected by genetic factors or environmental factors. High value of heritability shows that genetic factors more of a role in controlling a trait than environment factors. The number of pods and seed weight per plant has high value heritability.

Based on the test, obtained that character of height plants, the days of flowering, the number of pods per plant and seeds weight per plant was high category (Table 2). This shows that characters is controlled more by genetic factors compared with environment factors. Selection of high heritability characters to start in early generation[7], while the characters the number of branches and weights 100 seeds has a value of heritability was medium.

### Table 2. The Value of Broad Heritability ($h^2$) and Genetic Coefficient

| Variance F3 Lines by Crossing Agromulyo and Tanggamus | Heritability ($h^2$) | Note | Genetic Coefficient Variance (GCV) | Note |
|------------------------------------------------------|----------------------|------|------------------------------------|------|
| Height plant (cm)                                    | 2.09                 | High | 24.67                              | Broad|
| The days of flowering (day)                          | 0.61                 | High | 4.62                               | Narrow|
| The number of branches (branch)                      | 0.22                 | Medium | 30.54                           | Broad|
| The number of pods (pod)                             | 0.68                 | High | 18.65                              | Medium|
| The day of harvest (day)                             | 0.03                 | Low  | 1.66                               | Narrow|
| Seed weight per plant (g)                            | 0.69                 | High | 46.23                              | Broad|
| weight 100 seed (g)                                 | 0.36                 | Medium | 10.39                           | Medium|

The value of the coefficients of the genetic diversity is presented in Table 2. The value of the CGV as to its character height plant, the number of branches and weights seeds per plant is considered to be broad. This shows the diversity of characters more caused by a genetic factor and matter used is a collection of different germ plasm background genetics[8].

Character of height plant, number of branches, number of pods, seed weight per plant and weight 100 seed have medium until high of heritability and CGV was medium until broad. That is may be used as selection character. High heritability and broad CGV may be cause response additive gene, while narrow CGV because of not additive gene (dominan or epistasis gene).

Beside the parameter genetic, correlation between kuantitative character with yield has significant meaning in selection. The result of the analysis kuantitative character to weight seed per plant can be shown in Table 3. The correlation between weight seed per plant character with character of height plant ($r= 0.614^*$), number of branch ($r= 0.666^*$) and number of pods ($r= 0.857^*$) has positive significant. This show that there is relationship inline which meaning more heighter plant and more many number of branch and number of pods per plant formed. If the correlation between characters were negative non significant, example character of weight seed per plant with the day of flowering ($r= -0.092^*$). This indicated that height plant not followed by quickly the day of flowering. The plant was high tending to have the day of flowering was older or long live plant.

Selection was effective done if parameter genetic character estimate was high, followed correlation was significant to weight seed per plant character. Based on parameter genetic estimate, correlation was significant between number of pods per plant with weight seed per plant so a few lines selected what have highest weight seed per plant by direct selection method. Direct selection method used because of only weight seed per plant has high heritability and broad CGV.
Table 3. Fenotific Correlation of Quantitative Character of F3 Lines by Crossing Agromulyo and Tanggamus

| Karakter | TT   | UB   | JC   | UP   | JPTN | BBTN | B100 |
|----------|------|------|------|------|------|------|------|
| TT       | 1    | -0.198 | 0.616* | 0.013 | 0.674* | 0.614* | 0.431* |
| UB       | 1    | -0.127 | 0.084 | -0.125 | -0.092 | -0.026 |
| JC       | 1    | 0.190 | 0.721 | 0.666* | 0.452* |
| UP       | 1    | 0.154 | 0.071 | 0.155 |
| JPTN     | 1    | 0.857* | 0.466* |
| BBTN     | 1    | 0.490* |
| B100     | 1    |      |

Note: TT= Height Plant, UB= The Day of Flowering, JC= Number of branches, UP= The Day of Harvest, JPTN= Number of Pod per Plant, BBTN= Weight Seed per Plant, B100= Weight 100 seed

Selection is a breeding process and base on repairing of all plants to find new superior kultivar and genetic variance was broad. Selection of every plant was important done to can be used to next planting process the higher the percentage that genetic purity. Selection of every plant based on special marker each population by looking traits in earlier generations.

Table 4. Selected Lines Based on Weight Seed per Plant Character

| Number of Lines | Weight Seed/plant (g) |
|-----------------|-----------------------|
| 4               | 68.53                 |
| 97              | 65.50                 |
| 44              | 62.74                 |
| 73              | 57.32                 |
| 89              | 48.89                 |
| 14              | 48.72                 |
| 93              | 48.72                 |
| 87              | 45.49                 |
| 79              | 45.11                 |
| 76              | 43.45                 |

Selected lines can show on Table 4. The increasing of weight seed per plant influenced by genetic and environment factor. Because of weight seed per plant character is always used as a selection character.

4. Conclusions
The result of analysis heritability for all character had medium until high only the day of harvest had been low. The narrow CGV only for the days of flowering and harvest character, while the other character the value of CGV was medium until broad. Correlation between character was positive and significant, only the day of flowering was negative and not significant. Based on high heritability and broad CGV, the selection done to weight seed per plant character, so selected 10 advanced lines with the highest weight seed per plant.

References
[1] M. Barmawi, A. Yushardi, and N. Sa, “AGRONOMI KEDELAI GENERASI F 2 HASIL PERSILANGAN ANTARA YELLOW BEAN DAN TAICHUNG,” 2013.
[2] D. Wirnas et al., “Keragaman Karakter Komponen Hasil dan Hasil pada Genotipe Kedelai Hitam,” J. Agron. Indones., vol. 40, no. 3, pp. 184–189, 2012.
[3] Miftahorrachman, “Korelasi dan analisis koefisien lintas karakter tandan bunga correlation and path coefficient analysis of bunch character on fruit set of salak dwarf coconut,” Bul. Palma, no. 38, pp. 60–66, 2010.
[4] A. Krisnawati et al., “Seleksi populasi F5 kedelai berdasarkan karakter agronomis Selection of soybean F5 population based on agronomic characteristics,” PROS SEM NAS MASY BIODIV INDON, vol. 1, no. 3, 2015, doi: 10.13057/psnmbi/m010309.

[5] Z. Iqbal, M. Arshad, M. Ashraf, R. Naeem, M. Faheem Malik, and A. Waheed, “GENETIC DIVERGENCE AND CORRELATION STUDIES OF SOYBEAN [GLYCINE MAX (L.) MERRILL.] GENOTYPES,” 2010.

[6] R. T. Hapsari, “Pendugaan Keragaman Genetik dan Korelasi Antara Komponen Hasil Kacang Hijau Berumur Genjah,” Bul. Plasma Nutfah, vol. 20, no. 2, p. 51, 2016, doi: 10.21082/blpn.v20n2.2014.p51-58.

[7] L. Hakim, “Komponen Hasil dan Karakter Morfologi Penentu Hasil Kedelai pada Lahan Sawah Tadah Hujan Yield,” 2017.

[8] Trustinah and R. Iswanto, “Keragaman bahan genetik galur kacang hijau,” Pros. Semin. Has. Penelit. Tanam. Aneka Kacang dan Umbi, no. 0341, pp. 465–472, 2012.