

Protein Content Analysis of Soybean [*Glycine Max* (L.) Merr.] Lines Results from the Crossing between Detam-2 Varieties with Grobogan

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Abstract. Soybean is a plant that is widely used in the food industry and one of the main sources of vegetable protein. The lack of soybean supply in 2016 to 2020 was 1.60 million tons, 1.78 million tons, 1.84 million tons, 1.92 million tons and 1.91 million tons, respectively. Soybean protein content ranges from 35-40%. Protein needs of 55 grams per day can be met with foods derived from 157.14 grams of soybeans. This study aims to determine the protein content of the soybean lines from the crossing varieties of Detam 2 with Grobogan. Based on the research results, it obtained line that has high protein content values, namely F6DxG 50-35-4. Overall, the heritability estimated value for all lines have a high estimated value, which means that the characters observed are genetically inherited.

Keywords: soybean lines, protein content analysis, crossing of soybean.

1 Introduction

One of legumes that have a very important role is the soybean crop, which is used widely in the food industry and is one of the main sources of vegetable protein [1]. Currently consumer demand for soybean commodity not only in quantity but has led to the quality as well. At some centers in soybean production there has been a shift in consumer preference from soybean-sized seed medium (about 10 g / 100 seeds) into a soybean-sized large seeds (> 14 g / 100 seeds) and soybeans that have early maturity (<80 days) [2].

Based on projected results, is expected to balance production and consumption of soybean in Indonesia increased deficit in the years 2016 - 2020 average of 36.95% per year. Soybean supply shortage 2016 and 2020 amounting to 1.60 million tons, 1.78 million tons, 1.84 million tons, 1.92 million tons and 1.91 million tons [3].

Selection is a process of plant breeding and foundation of the entire repair plant to obtain new superior cultivars [4]. Selection of pedigree is one selection in segregating populations aimed at obtaining new varieties by combining desirable genes found in two or more genotypes are expected to produce a derivative better and superior to the parent [5].

Plants that containing intact soy protein content by 35-40%, which is almost equivalent to the protein content of meat. Protein soybean crop is the only one of the types of nuts that has the essential amino acid composition of the most complete [3]. Soy protein requirement of 55 grams per day can be filled with food that comes from 157.14 grams of soy [6].

This study aims to determine the protein content of a number of lines of soybean (*Glycine max* L. Merrill) of crossbred varieties detam 2 with Grobogan.

2 Research Methods

This research was conducted at tissue culture laboratory and research area of Faculty of Agriculture Universitas Sumatera Utara, Medan. This research was carried out in March to October 2019.

Seed Selection

The seed used is a seed that has a normal size or no wrinkles and no fowl.

Preparation of Land

The area required for the research first measured in accordance with the requirements, then cleared weeds there. Then formed as a drainage ditch on the land and made a plot with a size of 2.4 mx 4 m to 4 plots with 50 cm distance between plots.

Planting

Planting is done by making the planting hole at planting area with a depth of ± 2 cm, then put one seed per planting hole and then closed again.

Fertilization

Fertilization is done according to recommended dosage of soybean fertilizer requirements.

Maintenance Plants

Plant maintenance is watering plants, weeding and maintenance of plants from pests and plant diseases.

Harvest

Harvesting conducted by picking the pods one by one using hand. Harvesting is done in accordance with the harvesting each crop varieties. Criteria soybean harvest is marked by skin brownish-yellow pods by 95% and the leaves have fallen.

Analysis of Protein

Analysis of protein was observed by the method performed by Bradford (1976).

3 Results and Discussion

The soy protein content

F6 plant populations indicates that the amount of the protein content of each line is lower than the varieties Detam-2 which has a protein content of 45.58%. This is influenced by environmental conditions and requirements grow soybeans states that a high protein content in soy beans led to the need of nutrients nitrogen (N) more, so the availability of N in infancy is very important to obtain optimal results [7].

Table 1. Values F6 protein assay with elders detam DXG and Grobogan along with comparison factor (gram)

	detam	Anjasmoro	Grobogan	G5	G50	G49	G13	G80
sample 1	0.37	0.54	0.47	1.07	1.57	1.04	0.74	0.87
sample 2	0.58	0.53	1.54	0.87	1.04	0.92	1.05	0.83
sample 3	0.36	0.46	0.42	0.09	2.34	0.08	0.93	2.97
sample 4	0.38	0.07	0.73	0.81	6.78	1.01	0.84	2.87
sample 5	0.89	0.47	0.93	0.95	0.94	0.96	0.99	0.93
Total	2.58	2.07	4.09	0.46	12.67	4.73	4.55	8.47
Mean	0.52	0.41	0.82	0.92	2.53	0.95	0.91	1.69

The results of the analysis of protein content test showed that the highest levels of the protein contained in the 50 lines contained in the sample 4. This indicates that the sample 4 line G50 has a clear difference with two parents plus the comparative crops. The important aspect of soy as a source of functional food can be observed from the nutrient content in seeds. On the basis of dry weight, soybeans contain about 40% protein, 20% oil, 35% carbohydrates soluble (sucrose, stachyose, raffinose, etc.) and carbohydrates insoluble (dietary fiber), and 5% ash [8].

Coefficient of high genetic diversity found in plant height, number of primary branches, number of pods per plant, number of pods contain, the number of seeds and seed weight. KKG high value showed the presence of the genetic and phenotypic diversity that is high so as to facilitate the selection done [9] states that the value of the coefficient of the high diversity in the character - specific code indicates that the selection will be made effective. Characters with high diversity values can be said to have extensive genetic diversity and vice versa.

Table 2. Values Diversity Genetic (KKG) on the Detam X Grobogan (D X G) at F6 generation

Genotype	Character	σ^2_g	h^2	KKG (%)
F ₆ D X G 50-35-4	Flowering age	0.664	0.664 (H)	2.144 (L)
	Plant height	34.079	0.781 (H)	16.138 (H)
	Number of primary branches	0.438	0.572 (H)	16.123 (H)
	Harvest age	8.905	0.797 (H)	2.794 (L)
	number of crop pods	673.288	0.998 (H)	41.118 (H)
	number of pods contained	506.453	0.998 (H)	52.919 (H)
	number of planting seeds	1436.110	0.998 (H)	54.178 (H)
	seed weight of the plant	21.141	0.988 (H)	53.540 (H)
	weight of 100 seeds	0.175	0.097 (L)	3.371 (L)
F ₆ D X G 13-4-1	Flowering age	2.068	0.860 (H)	3.710 (L)
	Plant height	71.526	0.882 (H)	26.805 (H)
	Number of primary branches	0.995	0.752 (H)	27.810 (H)
	Harvest age	1.469	0.393 (M)	1.142 (L)

Genotype	Character	σ^2g	h^2	KKG (%)
	number of crop pods	995.702	0.999 (H)	52.261 (H)
	number of pods contained	562.346	0.998 (H)	71.044 (H)
	number of planting seeds	1679.697	0.999 (H)	74.284 (H)
	seed weight of the plant	24.571	0.990 (H)	71.244 (H)
	weight of 100 seeds	2.943	0.644 (H)	13.585 (M)
F ₆ D X G 5-36-5	Flowering age	3.131	0.903 (H)	4.597 (L)
	Plant height	56.964	0.856 (H)	20.946 (H)
	Number of primary branches	1.406	0.811 (H)	31.894 (H)
	Harvest age	0.189	0.077 (L)	0.411 (L)
	number of crop pods	854.944	0.999 (H)	50.324 (H)
	number of pods contained	471.001	0.997 (H)	66.125 (H)
	number of planting seeds	1327.021	0.998 (H)	73.081 (H)
	seed weight of the plant	20.344	0.987 (H)	71.073 (H)
	weight of 100 seeds	1.211	0.427 (M)	8.547 (M)
F ₆ D X G 49-19-3	Flowering age	1.424	0.809 (H)	3.140 (L)
	Plant height	66.124	0.874 (H)	24.105 (H)
	Number of primary branches	1.512	0.822 (H)	30.741 (H)
	Harvest age	0.204	0.082 (L)	0.426 (L)
	number of crop pods	1156.319	0.999 (H)	54.711 (H)
	number of pods contained	729.983	0.998 (H)	77.280 (H)
	number of planting seeds	2003.609	0.999 (H)	79.332 (H)
	seed weight of the plant	33.108	0.992 (H)	77.004 (H)
	weight of 100 seeds	16.522	0.910 (H)	30.014 (H)
F ₆ D X G 80-48-3	Flowering age	0.958	0.740 (H)	2.531 (L)
	Plant height	93.187	0.907 (H)	28.730 (H)
	Number of primary branches	1.584	0.828 (H)	35.956 (H)
	Harvest age	-0.793	-0.537 (M)	0.000 (L)
	number of crop pods	1096.574	0.999 (H)	54.485 (H)
	number of pods contained	592.761	0.998 (H)	74.658 (H)
	number of planting seeds	1904.685	0.999 (H)	80.160 (H)

Genotype	Character	σ^2_g	h^2	KKG (%)
	seeds			
	seed weight of the plant	30.846	0.992 (H)	87.128 (H)
	weight of 100 seeds	0.742	0.313 (M)	7.427 (M)

Information: H=High, M=Medium, L=Low

In F6 plant populations showed that the character that has the highest diversity of parameters contained in plant height, number of primary branches, number of pods cropping, pods contain, the number of crop seeds and planting seed weight. Characters that have low diversity values contained in the parameter flowering date and time of harvest, and the characters have a value of genetic diversity that are contained in the 100-seed weight parameters. Coefficient of high diversity in the character - specific code indicates that the selection will be made effective. Characters with high diversity values can be said to have extensive genetic diversity and vice versa. Extensive genetic diversity indicates a more dominant genetic influence than the environmental effects [9].

Extensive genetic diversity can provide an opportunity for breeders to be able to make the selection. Selection is a process of plant breeding and foundation of the entire repair plant to obtain new superior cultivars. The success of the selection depends on the ability of breeders to separate the superior genotypes of unwanted genotypes [10].

4 Conclusions

Based on the research results obtained, lines that have a high protein content value, namely F6 D x G 50-34-5 compared to other lines. Overall, the heritability estimated value for all lines have a high estimated value, which means that the characters observed are genetically inherited.

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