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Identification of growth performance of soybean (*Glycine max* (L.) Merrill) genotypes in F_1 generation

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Soybean is a food crop that is widely cultivated in Indonesia. Soybean needs are increasing both used for food and non-food industry raw materials. Making varieties by crossing several superior varieties is expected to produce soybean varieties that have better properties than their parents. Before the crossing of plants, it is necessary to know in advance the characteristics of the plants to be crossed. This study aims to determine the agronomic character of 5 soybean varieties along with 20 results of dialel crossing and to determine the growth response and yield of 5 soybean varieties with 20 yields of dialel crossing. The crossed varieties include Dega-1, Gemasugen-1, Gemasugen-2, Sinabung, Gema. Based on the results of the study showed that twenty results of crosses and five generations of F_1 soybean parents showed significantly different results on parameters of plant height, number of fertile books, number of primary branches, age of flowers, harvest age, number of pods, number of empty pods, number of seeds per plants, seed weight per plant and weight of 100 seeds. Genotypes from Gemasugen-2 and Dega-1 crosses have higher yield potential compared to other crossing results. The results of the Gemasugen-2 crossing with Dega-1 and Gemasugen-2 with Gemasugen-1 also have more early age (74 days) compared to other cross-bred soybean genotypes in the F_1 generation.

Keywords: Identification, Soybean, Growth

INTRODUCTION

Soybean (*Glycine max* (L.) Merill) is a food commodity that is widely cultivated in Indonesia as a raw material for the food industry and is also used for non-food industry raw materials. Soybeans play an important role for the human body as a source of protein, carbohydrates and vegetable oils. Every 100 g of soybean seeds contains 18% fat, 35% carbohydrates, 8% water, 330 calories, 35% protein and 5.25% minerals (Suprapto, 1985). Soybean is an important food ingredient that can be used as a basic ingredient in making tempeh, tofu, tauco, soy sauce, bean sprouts and as a mixture of animal feed ingredients. Soy flour is a raw material for making milk, cheese, bread, cakes and others. Soybeans can also be used as an industrial material for non-food products, such as paper, liquid paint, printing ink, textiles and microbiology (Suhaeni 2007).

The need for soybeans in Indonesia every year always increases along with increasing population growth. Therefore, it is necessary to supply additional soybeans that must be imported from abroad because domestic production does not meet the needs so that land expansion and productivity must be carried out (Irwan, 2006). Domestic soybean production is still relatively low, which is only 1.1 tons ha. Low domestic production is also caused by a number of obstacles, one of which is the narrowing of land that has been converted into residential areas and industrial needs. To meet the increasing domestic demand, soybean imports are carried out by the government due to the inability of local production to meet domestic soybean needs. According to the BPS of East Java Province, soybean crop production in Jember City, East Java is tidal each year, the last in 2016 the amount of soybean production in the city of Jember is 22,027 tons, this number decreases compared to production in 2015 of 25,178 tons (BPS Jatim, 2016)

The imbalance between the ability to produce soybeans in the country and the increase in demand has actually occurred in a long time. During the period of 1993-2015 the increase in soybean production had reached 4.75%, but that number was not sufficient because during this period the demand for soybeans was greater at 5.74%. Until 2015, national soybean consumption reached 1.9 million tons, while the production obtained was still low at 600 thousand tons. So that to meet the soybean needs the government imports approximately 1.3 million tons of soybeans (Agricultural Research and Development Agency, 2015).

The productivity of soybeans can be increased again to 1.5-2.5 tons ha, using the application of advanced technology and more intensive cultivation systems. There are several steps that can be taken to increase soybean productivity, for example by using fertilizers efficiently, planting time that is appropriate to the carrying capacity of the land, and using superior varieties that have wide adaptation to various agroecosystems (Martodireso and Suryanto, 2001). One factor that plays an important role in soybean productivity is the selection of varieties, because to achieve high yields is largely determined by their genetic potential. Potential results in the field are influenced by interactions between genetic factors and management of environmental conditions. If the management of the growing environment is not done well, the high yield potential of the superior varieties cannot be achieved (Adisarwanto 2005). Medium and deep (> 80 days) soybeans have a higher risk of yield failure compared to early maturing soybeans (<80 days), with a shorter age, there will be a form of plant defenses against drought because plants are ready to harvest before the dry season (Adie and Krisnawati, 2007). Using early maturing soybean varieties will overcome problems due to climate change, the use of these varieties also reduces the risk of crop failure caused by drought, another advantage that is obtained is reducing the number of pests and can increase the crop index in a year (Ismail and Effendi, 1985).

Soybean plants are food plants in the form of shrubs that grow upright and come from the Manshukuo area (North China). Soybean plants began to be cultivated in Indonesia in the 17th century as food crops. This plant spreads throughout Indonesia and East Asian countries (AAK, 1989). According to Sumarno *et al*. (1990) cited by Cahyarini *et al.* (2004), soybean plants (*Glycine max* (L.) Merill) is one of the most cultivated food crops in Indonesia even though this plant is not native to Indonesia. It is estimated that soybeans were introduced by Chinese migrants at the beginning of the 18th century. Soybean is one of the C3 plants which means that there is not much need for sufficient sunlight in every growth. C3 plants are plants that do not require high intensity of sunlight so that these plants can form 3 carbon chains in carrying out photosynthesis (Salisburi and Ross, 1995).

Soybean plants have bush-shaped stems between 30-100 cm tall and each stem can form 3-6 branches. There are two types of stem growth, namely determinate and indeterminate. This difference is based on the presence of flowers and shoots of soybean plants. The determinate stem growth is indicated by stems that do not grow when the plants begin to flower while the indeterminate growth when the stem of the plant can still grow leaves even though the plants have begun to flower (Adisarwanto, 2005). Soybean flowers are shaped like butterflies and are arranged in groups in each leaf armpit (Hidajat, 1985). Soybean plants have a vegetative growth stage and reproductive stage. Vegetative conditions range from germinating plants to flower formation, while reproductive stages begin from flower formation to the seed ripening phase.

Soybean plants do not need shade because they are C3 plants so soybean plants will be more effective at temperatures between 23-27 degrees Celsius with altitudes between 0.5-500 m above sea level. This plant includes dicotyledonous plants that have wood on the stem and are included in the family of legumes. The need for soybeans in Indonesia every year always increases along with increasing population growth. Therefore, it is necessary to supply additional soybeans that must be imported from abroad because domestic production does not meet the needs so that land expansion and productivity must be carried out (Irwan, 2006).

There are 40 types of soybeans that grow wild in Southeast Asia. Four types of soybeans, namely the type Mansyuria, Japan, India and China. The basics of determining soybean varieties are based on age, seed color and stem type. The soybean varieties that are often used in Indonesia are Otan, No. 27, No.29, Ringgit 317, Sumbing 452, Merapi 520, Shakti 945, Davros, Economic Garden, Taichung 1290, TKG 1291, Clark 1293, New Order 1343, Galunggung, Lokon, Guntur, Wilis, Dempo, Kerinci, Raung, Merbabu , Muria and Tidar. In Indonesia, soybeans are currently widely planted in the lowlands that do not contain much water, such as on the north coast of East Java, Central Java, West Java, North Sulawesi (Gorontalo), Lampung, South Sumatra and Bali. Soybeans (*Glycine max* (L) merrill) is one of the cultivation plants with high nutrient content, including containing 30-50% protein. High protein content indicates that soybean plants need high nitrogen nutrients.

Soybean superior varieties in Indonesia are assembled for various purposes. Until 2016, the government has released 83 superior varieties of soybeans. These varieties have a variety of advantages and characteristics, both morphological and agronomic characteristics. The superiority of a variety can be assessed based on yield potential, ripe age, seed size, seed quality, resistance to biotic or abiotic stress, and adaptation environment. Understanding the superiority of varieties will make it easier for users to choose varieties, and understand the characteristics of varieties useful for maintaining the purity and genetic quality of varieties (Susanto and Nugrahaeni, 2015)

Increased soybean production can be done by improving the crop cultivation system optimally, which includes the use of quality seeds from superior varieties, control of plant pests, regulation of irrigation channels and cultivation techniques and fertilization. Increasing soybean productivity in Indonesia is in desperate need of the availability of high-yielding varieties with high potential and other superior properties. (Arsyad, 2000).

MATERIALS AND METHOD

Time and Place of Experiment

Research on "Identification of Growth and Results 25 Genotypes of Generation F1 *Glycine max* (L.) Soybean" will be held in April-completed at the Jember State Polytechnic Experiment Field in Jember Regency.

Materials and Tools

The materials used during the study included Dega-1, Gamasugen-1, Gamasugen-2, Sinabung, Gema, and 20 varieties from the 5 varieties, SP36, KCl, Urea, Compost. The tools used in this study include buckets, hoes, sprayers, labels, staples, stationery and other supporting tools.

Design of Experiment

The experiment used a Randomized Block Design (RBD) with 3 replications. Each of the 5 best plants was taken to be sampled.
Experimental treatments include:
A: Dega-1 varieties
B: Gamasugen-1 varieties
C: Gamasugen-2 Varieties
D: Sinabung Varieties
E: Gema varieties

Of the five varieties obtained 20 combinations of crosses consisting of:

1. A x B 5. B x A 9. C x A 13. D x A 17. E x A
2. A x C 6. B x C 10. C x B 14. D x B 18. E x B
3. A x D 7. B x D 11. C x D 15. D x C 19. E x C
4. A x E 8. B x E 12. C x E 16. D x E 20. E x D

From the results of these calculations, if the calculated value is significantly different, it will be continued by Scott-Knott's advanced test with a confidence level of 95%.

RESULTS

Based on the results of analysis of variance using the RAK design on 25 soybean genotypes shown in Table 4.1.

Table 1. Summary of the Value of F Counting

Charracter	F Calculated	
	Treatment	Replication
Plant height (cm)	8.73 **	0.56 ns
Number of fertile nodes	3.04 **	11.47 **
Number of primer branch	4.18 **	8.26 **
Age of flowers (R7)	42.14 **	0.72 ns
Age of harvesting (R8)	43.40 **	1.81 ns
Number of Filled pods	9.35 **	1.32 ns
Number of empty Pods	3.56 **	0.89 ns
Number orf seed per plant	9.76 **	2.93 ns
Weight of seed per plant	2.45 **	2.54 ns
100 seed weight (g)	29.39 **	0.69 ns

Each parameter that was observed showed that the characteristics of the parents of soybean plants and the results of their crosses each had different characteristics. This is evidenced by the results of variance on the treatment of each parameter that has a very different value. Each genotype produces different characteristics because there are differences in genetic makeup.

This is in accordance with the research of Milani et al. (2013) genetic factors greatly determine the appearance of each variety. Differences in genetic makeup can cause differences in phenotypic appearance of plants with special traits and characteristics. Environmental factors also determine the appearance of soybean genotypes. This is evidenced by the results of the variance of the groups of several parameters observed showing the results were not significantly different, from some of these results only the value of the number of fertile books and primary branches that showed different results was very real. The results of the variance of several parameters that have very different values will be further tested using Scott Knott with a confidence level of 95%.

Table 2. Results, yield components and other agronomic traits of the five soybean elders and dialel crosses

	Tinggi Tan. (cm)	Notasi Uji SK	Juml. Buku Subur	Notasi Uji SK	Juml. Cabang Primer	Notasi Uji SK	Umur Bunga (hari)	Notasi Uji SK	Umur Panen (hari)	Notasi Uji SK
A	43,59	b	11,87	a	2,27	a	30,00	a	90,00	d
B	57,81	c	17,67	b	3,47	a	30,33	a	87,33	c
C	57,79	c	17,87	b	2,93	a	30,33	a	81,33	b
D	65,91	c	18,07	b	3,73	a	35,00	c	91,33	e
E	61,52	c	17,20	b	3,53	a	35,00	c	88,67	c
AXB	45,43	b	16,00	b	2,80	a	30,00	a	91,00	e
AXC	56,70	c	19,67	b	3,40	a	31,00	a	89,67	d
AXD	34,72	a	14,03	a	2,35	a	30,67	a	91,33	e
AXE	43,25	b	18,27	b	3,00	a	30,33	a	91,33	e
BXA	48,17	b	19,87	b	3,87	a	30,00	a	87,33	c
BXC	46,70	b	18,53	b	3,67	a	30,00	a	88,00	c
BXD	46,53	b	18,67	b	3,53	a	30,00	a	87,33	c
BXE	49,91	b	18,87	b	3,60	a	30,00	a	91,33	e
CXA	61,41	c	17,67	b	3,40	a	30,33	a	74,00	a
CXB	54,52	c	17,60	b	2,93	a	30,00	a	74,00	a
CXD	52,49	b	19,00	b	3,53	a	30,00	a	81,00	b
CXE	59,72	c	19,47	b	3,60	a	30,00	a	85,67	c
DXA	59,65	c	18,40	b	3,87	a	35,00	c	88,67	c
DXB	65,95	c	18,73	b	3,80	a	35,00	c	88,67	c
DXC	64,81	c	16,73	b	3,67	a	35,00	c	89,67	d
DXE	59,72	c	18,60	b	3,93	a	33,00	b	92,33	f
EXA	52,12	b	17,73	b	3,80	a	35,00	c	92,67	f
EXB	56,69	c	20,93	b	4,20	a	35,00	c	92,33	f
EXC	57,99	c	20,27	b	3,67	a	35,00	c	89,67	d
EXD	65,29	c	16,53	b	2,93	a	35,00	c	89,70	d

A = Dega-1, B = Gemasugen-1, C = Gema- sugen-2, D = Sinabung, E = Gama;
SK Test = Scott-Knott Test 95%

Plant Height

Based on Table 2, the genotypes resulting from crosses that have the highest plant height are D x B (Sinabung x Gamasugen-1) with plant height of 65.95 cm, but not significantly different from A x C (Dega-1 x Gamasugen-2), C x A (Gemasugen-2 x Dega-1), C x B (Gamasugen-2 x Gemasugen-1), C x E (Gemasugen-2 x Gema), D x A (Sinabung x Dega-1), D x E (Sinabung x Gema), E x B (Echo x Gemasugen-1), E x C (Gema x Gemasugen-2), and E x D (Gema x Sinabung). While the results of crosses that show the lowest plant height is in genotype A x D (Dega-1 x Sinabung) with a plant height of 34.72 cm. Plant height can affect the number of branches and the number of fertile books formed on each plant. The higher the plant, the more the number of branches, the more the number of fertile books, the higher the yield of the plants. According to Mushoriwa (2013), the number of fertile books, plant height and weight of 100 seeds, positively correlated with soybean yields.

Number of Fertile Books

Fertile books formed on each plant range from 11-20 books. The genotype of the result of the crossing which has the highest number of fertile books is at the crossing of E x B (Gema x Gamasugen-1) and E x C (Gema x Gemasugen-2) with a value of 20 more books. The results showed that E x B (Gema x Gemasugen-1) and E x C (Gema x Gemasugen-2) had a high plant height and number of fertile books compared to other genotypes, according to Isnatin et al. (2015), plant height can also affect the number of fertile books. This is evidenced by the results of EXB crosses (Gema x Gemasugen-1) and E x C (Gema x Gemasugen-2) which have more plant height and more fertile books than other plants.

In plants that have a higher posture, there will also be more fertile books. The large number of fertile books will provide more number of pods. Strains that have a large number of fertile books and filled pods are generally indicated by lines with a longer cooking age (Nugrahaeni *et al.* 2012).

Number of Primary Branches

The average number of primary branches formed between 2-5 branches per plant. Plant parents who have a low primary branch are Dega-1 while the highest is Sinabung. The results of crosses that have the lowest primary branches are A x D (Dega-1 x Sinabung) and the highest E x B (Gema x Gemasugen-1). The highest number of primary branches was found in E x B crosses (Gema x Gemasugen-1) as many as 4.2 primary branches and different were not significant with all the results of crosses and with their parents.

Based on variance, the number of primary branches is also influenced by environmental factors, one of which is plant distance and light reception factor. According to Sundari and Wahyuningsih (2015), soybean plants that grow with low light intensity have fewer branches compared to soybean plants that have sufficient light reception. It is also related to the spacing, if the spacing is wider, the intensity of the light received will be higher and vice versa.

Flower Age

In Table 2, there are differences in the age of flowering between elders and genotypes with each other. If seen from 25 plants, the first flower appears on A (Dega-1), A x B (Dega-1 x Gamasugen-1), BXA (Gamasugen1 x Dega-1), B x C (Gamasugen-1 x Gamasugen -2), B xD (Gamasugen-1 x Sinabung), B x E (Gamasugen-1 x Reverberation), C x B (Gamasugen-2 x Gamasugen-1), C x D (Gamasugen-2 x Sinabung) and C x E (Gemasugen-2 x Gema) with the age of 30 days, but not significantly different from A x C (Dega-1 x Gemasugen-2), A x D (Dega-1 x Sinabung), A x E (Dega-1 x Reverberation) and C x A (Gamasugen-2 x Dega-1). While the results of the longest crossing of flowers appear in D (Sinabung), E (Gema), E x A (Echo x Dega-1), E x B (Gema x Gemasugen-1), E x C (Gema x Gamasugen-2) and E x D. Sudarmadji and Sudarmo (2007), 50% flowering age is positively correlated with plant age or harvest period, meaning genotypes/varieties that have 50% shorter flowering age, age of cooking genotype / these varieties are also shorter, or commonly referred to as early maturity

In Table 2, there are differences in the age of flowering between elders and genotypes with each other. If seen from 25 plants, the first flower appears on A (Dega-1), A x B (Dega-1 x Gemasugen-1), BXA (Gemasugen1 x Dega-1), B x C (Gemasugen-1 x Gemasugen -2), B xD (Gemasugen-1 x Sinabung 2) with the age of 30 days, but not significantly different from A x C (Dega-1 x Gemasugen-2), A x D (Dega-1 x Sinabung), A x E (Dega-1 x everberation) and C x A (Gemasugen-2 x Dega-1). While the (Sinabung), E (Gema), E x A (Echo x Dega-1), E x B (Gema x Gamasugen-1), E x C (Gema x Gemasugen-2) and E x D (Gema x Sinabung) which is 35 days after.

Plant age is influenced by the speed of flowering plants, as stated by Sudarmadji and

(Gamasugen-2 x Sinabung) and C x E (Gamasugen- results of the longest crossing of flowers appear in D B x E (Gemasugen-1 x Reverberation), C x B (Gemasugen-2 x Gemasugen-1), C x D flowering time is longer then the harvest will take longer. This is in accordance with the results of research, the age of flowering and age of harvesting or cooking pods are faster, namely C x B (Gamasugen-2 x Gemasugen-1) while the flowering age and the longest harvesting age are E x A (Gema x Dega-1).

Those spots were on the under surface of the leaves. This case matched the statement by Fachruddin (2000) that leaf rust attack is signed by the existence of gray small spots filled with uredium that slowly change color into dark brown and those spots are surrounded by yellow halos/rings. Leaf rust disease attacked the under surface of leaves first. The leaf rust symptoms which were brown colored on the under surface of leaves were the colony of fungi *P. Pachyrhizy urediospores* (Pradikta *et al*., 2013).

Harvest Age

Tabel 4.3. Hasil, komponen hasil dan sifat-sifat agronomi lainnya dari lima tetua kedelai dan persilangan dialelnya.

	Jmlh Polong Isi	Notasi Uji SK	Juml. Polong Hampa	Notasi Uji SK	Jumlah Biji/ Tan.	Notasi Uji SK	Berat Biji/ Tan.	Notasi Uji SK	Berat 100 Biji	Notasi Uji SK
A	31,33	a	3,40	a	67,27	b	11,94	b	17,59	e
B	69,07	c	3,20	a	143,67	c	14,44	c	10,07	b
C	51,67	b	2,67	a	114,60	c	8,98	a	7,96	a
D	77,60	c	4,00	a	164,47	d	17,55	d	10,81	b
E	82,73	c	4,13	a	170,40	d	18,29	d	10,85	b
AXB	51,53	b	2,80	a	120,40	c	19,89	d	16,45	d
AXC	71,47	c	3,80	a	142,13	c	18,54	d	13,29	c
AXD	26,23	a	2,03	a	58,40	a	7,62	a	12,61	c
AXE	58,33	b	3,60	a	123,00	c	10,46	b	8,72	a
BXA	62,27	b	3,53	a	132,60	c	11,47	b	8,68	a
BXC	67,80	c	4,07	a	141,13	c	13,82	c	9,79	a
BXD	64,67	c	2,73	a	140,33	c	13,28	c	9,49	a
BXE	85,73	d	4,53	b	184,33	d	15,76	c	8,49	a
CXA	97,27	e	3,60	a	209,00	d	17,98	d	8,53	a
CXB	68,27	c	2,60	a	145,47	c	12,83	c	8,89	a
CXD	79,87	c	2,80	a	171,67	d	15,11	c	8,76	a
CXE	98,27	e	4,47	b	202,80	d	18,57	d	9,29	a
DXA	98,07	e	4,33	b	206,80	d	22,93	d	11,35	b
DXB	81,87	c	3,80	a	174,60	d	19,85	d	11,45	b
DXC	74,47	c	3,40	a	162,07	d	15,83	c	10,04	b
DXE	79,13	c	5,60	b	168,60	d	15,55	c	9,40	a
EXA	76,65	c	3,80	a	162,47	d	15,66	c	9,78	a
EXB	89,13	d	6,47	b	185,40	d	20,41	d	11,36	b
EXC	86,60	d	5,47	b	184,67	d	19,17	d	10,61	b
EXD	77,27	c	5,40	b	150,27	c	27,81	d	10,76	b

A=Dega-1, B=Gamasugen-1, C=Gamasugen-2, D=Sinabung, E=Gama
Uji SK = Uji Scott-Knott dengan tingkat kepercayaan 95%

Number of Fill Pods

The highest number of pods contained in the results of the crossing of C x E (Gamasugen-1 x Gema) was 98.27 pods, as well as the results of the variance of the number of seeds per plant, C x E (Gemasugen-1 x gema) had the number of seeds height of 206.8 seeds. While the lowest number of filled pods is found in the results of A x D (Dega-1 x Sinabung) crosses of 26.23 pods and only has 58.4 number of seeds. According to the research of Sundari and Wahyuningsih (2015), the larger the size of the pods, the smaller the pods formed. Likewise, the size of small pods produces more pods.

Number of empty pods

Hollow pods are pods that do not have pithy seeds. Hollow pods are formed due to many factors such as imperfect flowering and being exposed to pests or diseases. Empty pods are usually found in the upper branches of plants, this is due to imperfect seed formation. The number of pods produced is influenced by the quality of pollen and the ability of pollen to fertilize the ovary. The amount of pollen that falls on the stigma also affects the success of the number of pods and seeds formed (Gardner et al, 1991). In this study, the number of empty pods formed ranged from 2.03 to 6.47 empty pods. The number of pods is an agronomic character that can be used as a selection criterion for obtaining high yield soybean crop varieties.

Number of seeds per plant

Each plant pod has a different number of seeds, some have one seed but some have two to three seeds per pod. The highest number of seeds per plant was seen in C x A (Gamasugen-2 x Dega-1), amounting to 209 grains per plant, followed by the results of C x E (Gamasugen-2 x Echo) crossing of 206.8 items. The lowest number of seeds per plant is found in the results of A x D crosses (Dega-1 x Sinabung) which produce only 58.4 items. However, if calculated using a weight of 100 seeds, A x D has a heavier weight compared to C x A.

The number of seeds per plant does not correlate with the number of filled pods per plant. This is due to differences in the size of seeds in pods and the number of seeds in pods. According to Sutoro et al (2008) states that seed weight is related to source and sink capacity. Source is large if it is not followed by a large sink capacity, the seed weight will be low, and vice versa.

Seed Weight per Plant

Seed weight per plant ranges from 7.6 g-27.8 g. Genotypes resulting from crosses that produce large quantities if calculated using the weight of 100 seeds, do not necessarily have a large amount of weight as well and vice versa, genotypes resulting from crosses that have a low number of seeds do not necessarily produce low weight as well, this is in accordance with the results of research showed that the largest seed weight was found in D x A (Sinabung x Dega-1) of 22.93 g but had a low weight of 100 seeds. Similarly, for parent A (Dega-1) the number of seeds per plant is low, but the seed weight per plant exceeds that of parent C (Gemansugen-2) which has a high number of seeds per plant but the weight of seeds is low. So that the seed weight per plant is determined by the number of seeds and the size of the seeds. Other factors that can affect it can also be due to damage to seeds such as the appearance of fungi on soybean seeds.

100 Seeds Weight per Plant

The results of the weight parameters of 100 seeds with the highest weight values were found in the results of A x B crosses (Dega-1 x Gemasugen-1) of 16.4 g, while the weight of the lowest 100 seeds was found in the results of cross B x E (Gemasugen-1 x Reverberation of 8.50 g, but it is not significantly different from A x E (Dega- x Echo), B x A (Gemasugen-1 x Dega-1), B x C (Gemasugen-1 x Gemasugen- 2), B x D (Gemasugen-1 x Sinabung), B x E (Gemasugen-1 x Dega-1), C x A (Gamasugen-2 x Dega1), C x B (Gamasugen-2 x Gamasugen-1), C x D (Gemasugen-2 x Sinabung), C x E (Gemasugen-2 x Gema), D x E (Sinabung x Gema) and E x A (Gema-x Dega-1).

According to Damanik *et al.* (2013), the weight calculation of 100 seeds can be used as an indicator to assess the quality and quality of soybean seeds after being harvested. The content of food reserves can affect the weight of the seed and can affect the amount of production to the speed of growing a seed. The germination process.

CONCLUSION

Based on the results of the research that has been done, some conclusions can be taken, namely:

Genotypes from Gamasugen-2 with Dega-1 (C x A) and Gamasugen-2 crosses with Gemasugen-1 (C x B) have more early age (74 days) compared to other crossbred soybean genotypes in F1 generation.

Twenty results of crosses and five generations of F_1 soybean parents showed significantly different results on the character of plant height, number of fertile books, number of primary branches, age of flowering, harvest age, number of pods, number of empty pods, seed weight per plant, number seeds per plant and weight of 100 seeds

Suggestion

The results of crossing Gemasugen-2 with Dega-1 can be continued as a hopeful strain that can be developed into new varieties. Further research is needed to find out more about the agronomic character of the next generation of soybeans. will run quickly if a seed has a lot of weight and food reserves so that it has more energy for the germination process. The amount of sprouts is also influenced by the food reserves they have, the growth rate of sprouts will also increase with the increase in seed size. There are differences in plant height, number of primary branches, number of pods, number of fertile books, weight of planting seeds and weight of 100 seeds, this is due to genetic factors and factors.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Moh. Setyo Poerwoko designed his plant breeding program as a whole.

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