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Advanced Yield Trial for Various Peanut Lines (*Arachis hypogaea* L.) at Sodonghilir, Tasikmalaya, West Java, Indonesia

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Abstract

This study aims to evaluate yield and yield components in several peanut lines planted in West Java, Indonesia. The genetic materials evaluated involved 21 genotypes consisting of 18 potential peanut lines (G100, G133, G142, G144, G199, G205, G209, G21, G234, G237, G33, G37, G41, G53, G54, G76, G84, G99) from a selection of 5 biparental population (GWS79A1/"Zebra", "Jerapah"/GWS79A1, "Zebra"/GWS79A1, GWS79A1/"Jerapah", "Zebra"/GWS18A1) and 3 comparative varieties ("Gajah", "Sima", and "Zebra") as controls. Results showed that genotypes have significant effects on plant height (at 9 and 10 WAP), number of branches (at 4, 10, and 12 WAP), flowering age, and harvest age. Some potential lines showed ideal characters expected of a high quality peanut plant. Based on characters of harvest age, dry pod weight, and productivity, G100, G41, G21, G205, and G84 can be considered the best potential lines. The evaluated lines demonstrated heritability values classified as high category for plant height, number of branches, age of flowering, age of harvest, harvest index, wet stover weight, fresh pod weight, number of filled pods, number of empty pods, percentage number of filled pods, and weight of 100 seeds characters. Additionally, these lines also show high productivity, and this character had heritability value classified as the medium category.

Keywords: genetic variability, heritability, peanuts, potential lines, single factor

Introduction

Peanuts are an important food crop in Indonesia as a source of vegetable protein and as an industrial raw material (Dinarto and Astriani, 2012; Wahyu et al., 2016). The annual demand for peanuts in Indonesia has increased by 4.4 %; however, peanut production only increased by 2.5% (Suryadi et al., 2013). The low productivity of peanuts is due to the limited available land, the cultivation technique is still simple with the use of seeds with low productivity, and peanut has been used as a rotational crop (Sumarno, 2015).

There is a need for development in farming techniques of peanut, including the provision of superior varieties with high productivity and good adaptability. Superior peanut varieties should have high dry pod weight, high productivity and early harvest. This study aims to evaluate these genotypes which able to approach or exceed the comparison varieties.

This research is an advanced study from preliminary yield trial with the same genetic material, in order to select peanut lines that have the best potential yield and good adaptability with the environment. This research determines which among the lines show superiority before being formed into superior varieties or released cultivars that can be commercialized.

Materials and Methods

This research was conducted on rain-fed rice fields in Citundun Village, Cikalong Village, Sodonghilir District, West Java, Indonesia with an altitude of 448 masl from December 2019 to April 2020.

Eighteen potential peanut lines (G100, G133, G142, G144, G199, G205, G209, G21, G234, G237, G33, G37, G41, G53, G54, G76, G84, and G99) originating from a selection of 5 biparental populations (GWS79A1/"Zebra", "Gajah"/GWS79A1, "Zebra"/

GWS79A1, GWS79A1/"Jerapah", and "Zebra"/GWS18A1) and 3 comparison varieties namely "Gajah", "Sima", and "Zebra" were used. These peanut lines were produced by Genetic and Plant Breeding Division of IPB University. Fertilizer was administered using dosage of 2 $ton.ha^{-1}$ of manure during soil cultivation one week before planting, and 100 $kg.ha^{-1}$ Urea, 100 $kg.ha^{-1}$ SP-36 and 100 $kg.ha^{-1}$ KCl which were given entirely at planting (Lukitas, 2006). One week before planting, dolomite ($CaCO_3$) of 300 $kg.ha^{-1}$ was given. During planting, insecticide with carbofuran (30 $kg.ha^{-1}$) was also administered.

A completely randomized block design consisting of one single factor (genotype) was used in this study. The treatments consisted of 18 potential lines and 3 comparison varieties, with each treatment repeated 3 times, so there were 63 experimental units. Each experimental unit comprised of a 4 m2 (2 m x 2 m) plot with a spacing of 40 cm x 20 cm where 1 seed per hole was added. The observation variables measured in this study included: number of gynophores, plant height (cm) at 9 and 10 weeks after planting (WAP), number of branches at 4, 10, and 12 WAP, flowering age (DAP), harvesting age (DAP), harvest index (%), wet stover weight (g), fresh pod weight (g), weight of dry pods (g), number of filled pods per plant, number of empty pods per plant, percentage of filled pods (%), productivity ($ton.ha^{-1}$), and weight of 100 seeds (g) measurement at post harvest. In order to determine the effect of all treatments used, analysis of variance (ANOVA) and the mean difference test of treatment with a level of α 5% were carried out. If the F test is significant, means were further separated by the DMRT (Duncan Multiple Range Test) at α = 5% using the STAR 2.0.1 application. The broad sense heritability was caluculated to compare genetic diversity and environmental variability. The broad sense heritability criteria can be divided into three categories: low <20%, medium 20-50%, and high> 50% (Syukur et al., 2015). The high heritability value indicates that the character is influenced by genetic factors and can be used to predict the progress of selection (Barmawi et al., 2013 ; Syukur et al., 2015).

Results and Discussion

The Effect of Genotypes on Plant Characters

Results of the F test showed that genotype had no significant effect on harvest index, wet stover weight, fresh pod weight, dry pod weight, number of gynophores, number of filled pods (pithy), number of empty pods, percentation of filled pods (%), weight 100 seeds and productivity. Meanwhile, genotype treatment had a significant effect on plant height at 9 and 10 WAP, the number of branches at 4, 10

Table 1. Recapitulation results analysis of variance for all measured variables of the peanut genotypes evaluated

Variables	Plant age (WAP)	F-test	CV (%)
Plant height	9	*	9.14
	10	*	7.47
Number of branches	4	*	13.40
	10	*	11.71
	12	*	15.94
Flowering age	10	*	0.42^
Harvest age	13	*	0.12^
Harvest index	14	ns	28.26
Wet stover weight	14	ns	23.11
Fresh pod weight	14	ns	31.26
Dry pod weight	Postharvest	ns	33.23
Number of gynophores	14	ns	27.72
Number of filled (pithy) pods	14	ns	25.10
Number of empty pods (empty)	14	ns	26.50
Percentage of filled (pithy) pods	14	ns	30.10
Weights 100 seeds	Postharvest	ns	17.23
Productivity	14	ns	33.21

Note: ns= not significant, *= significant according to F test at = 5%; ^= values after square root transformation; CV= coefficient of variance and 12 WAP, flowering age and harvest age (Table 1). According to Mattjik and Sumertajaya (2013) the relative diversity of the data is determined by the coefficient of variance (CV). The coefficient of variance (CV) in agriculture for field experiments is considered reasonable if it has a value in the range of 20-25% (Mukti, 2017). Plant height at 10 WAP had the smallest CV value (7.47%) and the weight of dry pods had the highest value (33.23%). This shows that the results of the trials are is satisfactory with some of the characters exceeding CV scores of 25%. However, many of the characters showed CV scores in the low to medium category.

Vegetative Growth of Various Peanut Genotypes

Plant height (cm)

Taller peanut plants are not particularly desirable because they lodge more easily than those that are shorter. However, tall plants with sufficient branching and large stem diameter do not lodge easily. Tall plants can cause the canopy to become moist, which could attract pests in peanut crops (Wahyu and Budiman, 2013). Peanut with a tall plant size also develop high branches that wrap around each other which, making it difficult during the harvesting process (Junaedi, 2011).

The plant height obtained at 9 WAP was between 38.86 - 59.63 cm and at 10 WAP it was between 46.20 - 71.53 cm. Based on plant height, the “Sima” variety was the highest and was significantly different at the age of 9 and 10 WAP with the evaluated lines and other comparison varieties. However, at the age of 9 WAP, the G142 line was not significantly different from the “Sima” variety (Table 2). On the other hand, the other 17 lines were not significantly different in height from “Gajah” and “Zebra” varieties at 9 or 10 WAP. Zebra is the comparison variety with the shortest plant height compared to other comparison varieties. The “Zebra” variety is the best parameter for the character of plant height in this study. This shows that 80.95% of the lines evaluated were short plants and were not significantly different from the “Gajah” and “Zebra” varieties (Figure 1).

Table 2. The mean value of plant height characters of the peanut genotypes evaluated

Genotype	9 WAP	10 WAP
G100	43.70cdefgh	52.67 defghi
G133	49.27 bcdefg	58.13 bcde
G142	53.50ab	63.40 b
G144	42.27 efgh	45.67 i
G199	40.53 h	46.87 hi
G205	49.67bcdef	62.03 bc
G209	40.73h	49.10fghi
G21	40.00h	48.00ghi
G234	50.63bcd	58.30bcde
G237	38.86 h	49.38fghi
G33	50.27 bcde	55.30cdefg
G37	43.30cdefgh	52.80defghi
G41	44.63 cdefgh	51.80efghi
G53	51.33 bc	59.67bcd
G54	49.90 bcde	57.40bcde
G76	42.57 defgh	54.57cdefgh
G84	41.40gh	47.07hi
G99	42.87 defgh	50.50efghi
“Gajah”	44.33cdefgh	56.57bcdef
“Zebra”	41.70fgh	46.20 i
“Sima”	59.63a	71.53 a

Note: The mean value followed by different letters indicates a significant difference based on test of DMRT (Duncan Multiple Range Test) at 5%.

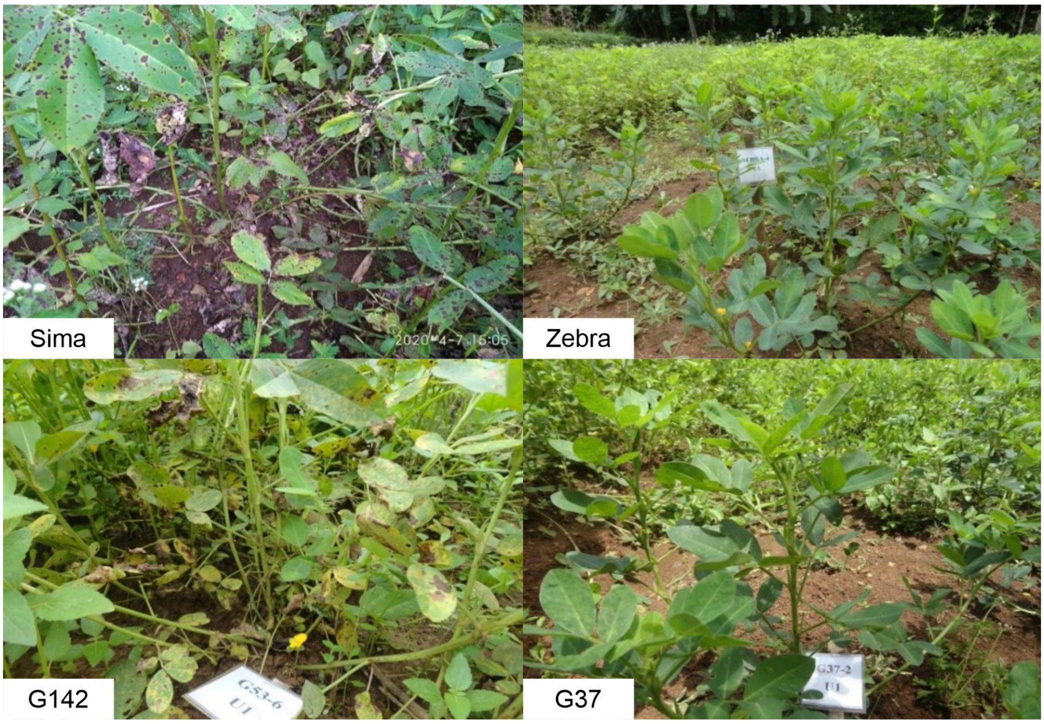

Figure 1. Performance of different variety of peanuts: “Sima”; “Zebra”; G142 line, which is not significantly different from “Sima”; G37 line, one of the peanut lines which is not significantly different from “Zebra”

Number of branches

The number of branches ranges from 4.03 - 7.33 at 4 WAP, 4.27 - 8.10 at 10 WAP, and 5.00 - 10.37 at 12 WAP (Table 3). G205 line had the highest number of branches and was significantly different from the other lines evaluated and with the “Gajah”, “Zebra”, and “Sima” as comparison varieties. It should be noted though that at the age of 10 WAP, the G205 line was not significantly different from the G142 line. At 12 WAP, G205 was not significantly different from the G33 G142 and G76 lines.

In contrast to most of the lines evaluated, including the comparison varieties which have upright growth type, the G205 line has spreading growth with the main stem upright (procumbent-1). Peanuts with upright growth type tend to have less branching compared to the spreading ones (Trustinah, 2015). Peanut plants with a higher number of branches are considered ideal because an increase in the number of branches in a peanut plant is associated with an increase in yield which will produce more pods and seeds (Wahyu and Budiman, 2013).

Generative Growth of Various Peanut Genotypes

Flowering age (days after planting)

The flowering age of the G33 line with an average of 66.00 DAP was significantly different from the other genotypes. The “Gajah” variety had the smallest average value of 47.00 DAP. This flowering age was shorter than the 2 comparison varieties and the potential lines evaluated.

The flowering age values for the G41, G53 and G37 lines were not significantly different have potentials as they are early flowering and early harvest, an important and desired character in peanut crop.

There are two types of peanut plant, Spanish type and Valencia type. Every type has special charactheristic. Spanish types are generally known to have early maturity, with 2 seeds / pods, slightly beaked, have pods with a slight waist, with slightly smooth reticulation, have sequential branching pattern, and with upright growth. Valencia types have late maturity, 2 seeds / pods, with large pods and seeds, with pods that are slightly beaked and slightly waisted, reticulation is slightly smooth-slightly coarse, have alternate branching patterns that are prostate upright (Kasno and Harnowo, 2014). In this study, the broad sense heritability of flowering age was 99.91% which chategorized as high, it meant that the performance of this character is more influenced by genetic rather than environmental factors.

Harvesting age (days after planting)

G237 line was significantly longer in harvest age with an average value of 109.67 DAP compared to the other lines and the comparison varieties evaluated. Meanwhile, the G21, G53, G54, G76, G84, and G99 lines were not significantly different from the "Gajah" variety with an average value of 99.33 DAP. "Gajah" variety is the best comparison variety because it shows the fastest harvesting age among other varieties. Harvest age is generally influenced by the type of peanut plant. If it is of the Virginia type, harvest age will be later compared to early harvesting age in Valencia and Spanish types (Kasno and Harnowo, 2014).

Harvest age is affected by there was disruption during the seed filling period (Purnamawati, 2012). Additionally, the level of pod maturity, pod weight, seed weight, and seed shell ripening index determine the harvest age of peanut plants (Nugroho et al., 2016). Genetic factors and environmental condition greatly affect the harvest age. The age of harvest is also determined by the interaction between the environment and the variety (Sumpena et al., 2013). The intensity of rainfall at the time of the study was moderate to high so that the seed filling period was disrupted, affecting the maturity of the peanuts.

Harvest index (%)

The harvest index is the result of dividing the economic yield and the biomass of the plant. The harvest index calculation aims to determine the efficiency of the use of plant biomass on yield, with the assumption that plant biomass affects the economic yield of plants (Lukitas, 2006).

Our study demonstrated that, there was no significant difference in the harvest index among the genotypes tested having a range of values of 12.74% - 25.17%. This shows that the efficiency of the stover weight or the vegetative component to obtain an economic yield in the form of pods in several evauated genotypes is relatively the same. The harvest index in this study was not significantly different between the evaluated genotypes presumably due to the weight of dry pods which was also not significantly different between the genotypes evaluated.

Wet stover weight (g per plant)

The stover weight shows the assimilation of photosynthate stored in the plant tissue (Junaedi,

Table 3. The mean value in number of branches branches of the peanut genotypes

Genotype	4 WAP	10 WAP	12 WAP
G100	4.67 cde	5.10 efg	5.37 f
G133	5.60 bcd	5.80 def	6.37 ef
G142	6.30 ab	7.23 abc	8.47 bcd
G144	4.67 cde	5.10 efg	5.53 f
G199	4.87 cde	5.03 efg	5.27 f
G205	7.33 a	8.10 a	10.37 a
G209	4.47 de	4.77 fg	5.00 f
G21	4.30 de	4.77 fg	5.27 f
G234	5.93 bc	6.53 bcd	8.10 cde
G237	4.13 e	4.72 fg	5.02 f
G33	5.87 bc	6.93 abcd	9.43 abc
G37	4.03 e	4.27 g	4.93 f
G41	4.80 cde	5.10 efg	5.37 f
G53	5.63 bcd	5.97 def	6.40 ef
G54	5.87 bc	6.20 cde	6.87 def
G76	6.00 bc	7.63 ab	10.17 ab
G84	4.33 de	4.90 fg	5.33 f
G99	4.33 de	4.70 fg	5.13 f
"Gajah"	5.33 bcde	5.93 def	6.53 ef
"Zebra"	4.40 de	4.90 fg	5.13 f
"Sima"	5.13 bcde	5.83 def	6.20 ef

Note: The mean value followed by different letters indicates a significant difference based on test of DMRT (Duncan Multiple Range Test) at 5%, WAP= week after planting

2011). Based on the analysis of variance, the evaluated genotypes were not significantly different in the character of wet stover weight. The mean value of wet stover weight characters is in the range of 115.30 g - 232.27 g. According to Wahyu and Budiman (2013) the stover weight of peanut plants is influenced by the number of branches formed. The increase in stover weight depends on the number of branches that are formed. In line with Wahyu and Budiman (2013), our results demonstrated that the G33 genotype, which has a large number of branches, had the heaviest wet stover weight compared to other genotypes.

Fresh pod weight (g per plant)

Peanut genotypes had similar weight of fresh pods. The range of fresh pod weight was 19.67 g to 42.17 g, fresh pod weight was influenced by seed weight and the number of pods. The number of filled pods obtained in this study was not significantly different between the evaluated genotypes, it was correlated with the weight of fresh pods which had not been able to provide optimal results. The environment during the pod filling period greatly affects pod weight. At the time of the study, the intensity of rainfall was moderate to high (300 - 500 mm per month) which resulted in low seed weight due to limited amount of light of radiation, which also inhibited the photosynthesis (Junaedi, 2011). In addition, the weight of fresh pods is influenced by the moisture content of peanut pods which is related to the environmental conditions during harvesting (Lukitas, 2006).

Dry pod weight (g per plant)

The genotypes evaluated were not significantly different in weight of dry pods. The mean range of dry pod weight for peanuts obtained was 8.73 g - 15.73 g. The weight of dry pods was influenced by environmental conditions during harvesting and the length of drying time. The low weight of dry pods in the study carried out could be due to the high rainfall at harvest time. Some pods germinated due to the moist soil (Lukitas, 2006). The amount of pods is

Table 4. Mean values for flowering age, harvesting age, harvest index, wet stover weight, fresh pod weight, and dry pod weight of the peanut genotypes evaluated

Genotype	FA (DAP) ^	HA (DAP) ^	IDX (%)	WSW (g)	FPW (g)	DPW (g)
G100	51.00 de	99.67e	22.34	198.03	37.27	14.07
G133	51.00 de	96.67 h	12.74	214.60	27.13	11.23
G142	51.00 de	99.67 e	16.49	158.27	25.80	10.87
G144	48.00 h	99.67 e	18.60	195.43	29.50	12.00
G199	53.00 b	101.67 d	23.80	181.23	35.53	15.00
G205	51.00 de	98.33 f	19.21	221.90	42.17	14.73
G209	43.00 l	101.67 d	25.13	155.50	32.17	14.17
G21	44.00 k	99.67 e	18.22	197.60	36.33	14.67
G234	43.00 l	97.67 g	26.90	140.87	32.77	12.73
G237	51.67 cd	109.67 a	19.37	169.86	30.27	11.10
G33	66.00 a	99.67e	18.36	232.27	40.80	14.80
G37	50.00 f	108.67 b	25.37	164.03	34.07	14.97
G41	50.33 ef	93.67 i	14.18	155.47	21.17	15.00
G53	50.00 f	99.33 e	21.22	115.30	19.67	8.73
G54	45.00 j	99.67 e	18.18	175.83	30.53	12.57
G76	48.00 h	99.67 e	17.03	187.63	31.50	13.70
G84	43.67 k	99.33 e	22.96	152.43	33.17	15.73
G99	52.00 c	99.33 e	19.91	173.73	31.27	13.60
“Gajah”	47.00 i	99.33e	23.35	127.57	28.53	13.33
“Zebra”	50.00 f	104.67c	20.90	166.53	33.30	13.33
“Sima”	49.00 g	98.67f	13.90	211.67	27.93	11.47

Note: The mean value followed by different letters indicates a significant difference based on test of DMRT (Duncan Multiple Range Test) level α 5%, FA = flowering age, HA = harvesting age, ^ = result from square root, IDX = harvest index, WSW = wet stover weight, FPW = fresh pod weight, DPW =dry pod weight, DAP = days after planting, (“ ”) = released cultivars influenced by the number of productive branches and the percentage of flowers forming the pods (Wahyu and Budiman, 2013). The low weight of dry pods in this study was due to the low number of flowers that formed into pods, presumably because some flowers had shed due to high rainfall. The number of branches per stem, number of pods per stem, number of seeds per stem, percentage of filled (pithy) pods, and yield of fresh pods were associated with the number of dry pods of peanuts (Atman, 2012). The number of fresh pods that were not significantly different was thought to have caused the low number of dry pods produced.

Number of gynophores

Based on genotype variety test, the number of gynophores of 31.85 - 50.17 among the lines was not significantly different The number of gynophores is influenced by the formation of flowers and their location on the peanut branches (Sianturi, 2008). Gynophores that are far enough from the ground (≥ 15 cm) will difficult to penetrate the soil because the tips will dry out and die (Trustinah, 2015). It was observed that most of the peanut plants evaluated had an upright growth type with sequential branching. According to Trustinah (2015), sequential branching patterns usually produce multiple flowers of the knuckles on the underside of the branches, so it has a shorter gynophore versus varieties with an alternate branching pattern. The inability of the gynophores to penetrate the soil resulted in a low percentage of pod formation (Faronika et al., 2013).

Number of filled pods

The number of filled pods is influenced by the success in gynophores to form pods. Furhermore, the number of gynophores is associated with flowering. Less than 55% of the flowers was formed gynophores, while the gynophores formed after maximum flowering till finished of flowering does not affect the yield (Junaedi, 2011). Based on variance analysis, the number of filled pods among the genotypes (0.33 - 17.30) did not vary significantly. The low number of filled pods is thought to be because the gynophores grow at branches that point upward which makes the gynophore which is quite short difficult to touch the ground.

Number of empty pods

Based on F test, genotypes evaluated were not significantly different in the number of empty pods (1.87 - 3.40) it meant that among genotypes evaluated did not vary significantly. The number of empty pod is influenced by the low weight of the seeds. Low seed weight occurs when there is disruption in the filling period of the pods. In addition, the quality of the seeds used is not good enough, causing the sprouts to grow abnormally so that the pods that are formed are not completely filling the seeds and cause empty pods (Asih, 2012). The decrease in rate of pod formation is due to disturbance during the flowering period (Faronika et al., 2013). One of the factors contributing to the low number of pods is the very long flowering period. The number of empty pods correlates with a soil heaping that is proven to reduce the number of empty pods because it makes the soil structure and drainage better for gynophore development and it also an attempt to bring gynophore closer to fertilizer so that it can be directly absorbed by the pods (Simanjuntak et al., 2014). During the study period, there was high rainfall, causing pods to be buried and damaged from soil erosion so that the filling is not effective. This led to a high yield of empty pods in this study.

Percentage of filled pods (%)

The percentage of filled pods is the quotient of the total pods by filled pods obtained from each plant. Based on the F test, the percentage of filled pods among genotypes did not vary significantly. The percentage of filled pods had a minimum value of 22.82% obtained from G99 and maximum value of 42.57% was obtained from “Gajah” (Table 5). These results show that the evaluated lines have not been able to keep up with the percentage of filled pods obtained by comparison varieties (Junaedi, 2011). The length of flowering period in peanuts results in low pod yields because the consecutive flowers become competitors in the use of assimilates, so that fewer pods are formed (Faronika et al., 2013).

Weight of 100 seeds (g)

The success of seedling production is determined by the weight of 100 seeds. Additionally, the fertilization of the seeds illustrates the amount of photosynthates that plants can accumulate into the seeds (Dinarto and Astriani, 2012). F test showed that the weight of 100 seeds was not significantly different between the genotypes evaluated. The weight of 100 seeds ranged from 25.00 g to 40.00 g. The weight of 100 seeds is influenced by the individual seed weight and the number of pods. Based on observations, most of the lines evaluated were Spanish and Valencia types with small seed size characteristics of 3 -7 mm (Kasno and Harnowo 2014).

Productivity

Crop productivity among the genotypes evaluated were not significantly different. The productivity

Table 5. The number of gynophores, filled pods, and empty pods, percentage of filled pods, weight of 100 seeds and productivity of the peanut genotypes evaluated

Genotype	NG	NFP	NCP	PFP (%)	W100 (g)	PRD (ton.ha^{-1})
G100	49.87	13.17	2.67	26.17	33.33	1.76
G133	41.67	12.43	2.90	31.11	38.00	1.40
G142	50.17	11.40	2.37	22.86	38.33	1.36
G144	39.00	11.60	2.60	31.13	35.67	1.50
G199	42.43	12.43	2.27	31.67	36.67	1.88
G205	42.30	17.30	3.40	42.23	37.67	1.84
G209	40.63	11.47	2.43	29.26	36.67	1.77
G21	45.87	11.83	2.47	26.15	38.33	1.83
G234	43.40	16.77	2.80	42.35	34.00	1.59
G237	31.85	9.73	2.25	31.50	25.00	1.39
G33	47.07	16.90	2.77	38.62	39.33	1.85
G37	41.63	12.60	2.57	30.83	35.33	1.87
G41	38.70	12.10	2.67	36.55	39.00	1.88
G53	32.97	13.23	2.17	39.73	31.67	1.09
G54	41.03	14.33	2.80	36.93	36.00	1.57
G76	43.73	15.60	2.90	38.51	42.33	1.72
G84	47.07	13.57	2.20	32.27	36.00	1.97
G99	49.70	11.33	2.93	22.82	35.67	1.70
“Gajah”	38.40	14.93	1.93	42.57	38.00	1.67
“Zebra”	36.93	10.63	2.77	33.38	33.33	1.67
“Sima”	42.03	9.33	1.87	23.54	40.00	1.43

Note: The mean value followed by different letters indicates a significant difference based on test of DMRT (Duncan Multiple Range Test) level α 5%, NG= number of gynophores, NFP= number of filled pods, NCP= number of empty pods, PFP= presentage of filled pods, W100= weight of 100 seeds, PRD= productivity, (“ ”)= released cultivars.

of peanut plants in this study had a maximum value of 1.88 ton.ha^{-1} and a minimum value of 1.09 ton.ha^{-1}. High productivity in peanuts is influenced by the weight of filled pods (pithy) per plot (kg) and weight of 100 seeds (g). This is consistent with the weight of filled pods and weight of 100 seeds in this study which have not given good enough results, presumably causing low productivity (Harsanti and Parno, 2017). In addition, the productivity of legumes depends on the number of pods per stem, the number of seeds/stems, and the weight of the seeds (Atman, 2012). Furthermore, low dry pod weight and low seed quality is one of the factors in the low value of peanut plant productivity (Wang et al., 2015)

Genetic Variability and Heritability

Based on heritability estimation, the broad sense heritability value (h^2_{bs}) obtained for this study ranged between 32.84% - 99.95% or medium to high (Table 6). Characters which showed high heritability values included plant height, number of branches, flowering age, harvest age, harvest index, wet stover weight, fresh pod weight, number of filled pods, number of empty pods, percentage of filled pods, weight of 100 seeds, and productivity. On the other hand, number of gynophores and weight of dry pods have medium heritability values.

High genetic diversity indicates the potential of a population as a source of genes, so that improvement programs can be carried out in the future (Makinde and Ariyo, 2013). Moreover, the stability of the results of each genotype evaluated is a description of static stability (genetic factors) and dynamic stability (environmental factors). Breeders prioritize static stability to produce plants with high yield potential that are not affected by various environments (Purnomo et al., 2019). Genotypes with high dynamic stability will produce plants with specific location characteristics, meaning that the adaptation of these plants is relatively narrow (Mafouasson et al., 2018) there is low availability of N in the soil mainly due to continuous cultivation of the land, crop residues removal, little or no application of fertilizers and rapid leaching. There is a need to develop low N tolerant and adapted

Table 6. Genetic variability, heritability and genotypic coefficient of variability of the evaluated peanut genotypes

Variable	σ^2g	σ^2e	σ^2p	h^2_{bs} (%)	GCV (%)
PH	126.34	5.46	131.80	95.86*h*	20.76*l*
NB	8.98	0.36	9.33	96.18*h*	46.17*l*
FA	0.34	0.0003	72.86	99.91*h*	8.26*n*
HA	0.09	6.6	0.09	99.92*h*	2.99*n*
IDX	34.71	10.56	45.27	76.68*h*	29.59*l*
WSW	2265.69	551.20	2816.89	80.43*h*	27.05*l*
FPW	59.86	32.27	92.13	64.97*h*	24.58*l*
DPW	3.15	6.44	9.59	32.84*m*	13.4*m*
NG	30.08	45.62	75.70	39.73*m*	12.99*m*
NFP	11.90	3.54	15.44	77.07*h*	26.55*l*
NCP	0.25	0.15	0.41	62.27*h*	19.64*m*
PFP	90.23	32.62	122.85	73.45*h*	28.90*l*
W 100	25.52	12.97	38.48	66.31*h*	13.95*m*
PRD	0.05	0.10	0.15	32.89*m*	13.46*m*

Note: σ^2g= genetic variability, σ^2e= environment variability, σ^2p= phenotype variability, h^2_{bs}= heritability broad sense, GCV= genotyphic coefficient of variability, *h*= high, *m*= medium, *l*= large, *n*= narrow, PH= plant height, NB= number of branches, FA= flowering age, HA= harvesting age, IDX= harvest index, WSW= wet stover weight, FPW= fresh pods weight, DPW= dry pods weight, NG= number of gynophores, NFP= number of filled pods, NCP= number of empty pods, PFP= percentage of filled pods, W100= weight of 100 seeds, PRD= productivity.

maize genotypes. Evaluation of maize genotypes under different nitrogen conditions would therefore be useful in identifying genotypes that combine stability with high yield potential for both stress and non-stress environment. Eighty maize hybrids were evaluated at Mbalmayo and Nkolbisson in Cameroon, during 2012 and 2013 minor and major cropping seasons across 11 environments under low and high N conditions. The selection program recommends selecting genotypes with broad adaptation traits, particularly plants that can adapt to various types of environment (Savemore et al., 2017).

Heritability prediction value demonstrates whether a character is controlled by genetics or the environment, so that it can be seen to what extent the character is inherited from the offspring (Widyawati et al., 2014). Character appearance can be determined by estimating the heritability value, namely to determine the genotype or environmental factors that play a greater role (Priyanto et al., 2018). For example, the character of peanut productivity which has a heritability value of 32.89% means that the character is influenced by genetic factors of 32.89% and 67.11% is influenced by environmental factors. Efforts to increase peanut productivity should take into account the environmental factors including agro-ecosystem and farming techniques and improve the genetic characters. Heritability values are important in selection programs because the proportion of heritability values will reflect the genetic potential of a plant character (Nurhidayah et al., 2016).

It can be inferred that the heritability value for almost all evaluated characters in this study was high (Table 6). It means that the difference in genetic diversity and phenotype values is very small (Gultom et al., 2017). This is presumably because the environmental influence received by each individual is relatively uniform, there by increasing the heritability value (Austi et al., 2014). The great selection is determined by the breadth of values genotyphic coefficient of variability (GCV), because the genetic component is a major factor in the selection program. Value criteria of GCV divided into three parts namely narrow 0-10%, medium 10-20%, and large > 20% (Effendy et al., 2018). Genes that segregate and interact with other genes will cause genetic variation. The effectiveness of selection is determined by the source of genetic variability. The greater the genetic variability, the more effective the selection (Septeningsih et al., 2013). The value of GCV obtained ranged from 6.20% - 106.47%, with plant height, number of branches, harvest index, wet stover weight, fresh pod weight, number of filled pods, percentage of filled pods, productivity included in the broad GCV category. Meanwhile, flowering age, dry pod weight, gynophore number, number of empty pods, the weight of 100 seeds were in the medium category, and the harvest age variable was in the narrow category (Table 6).

Conclusion

The potential lines of peanut have been able to perform well, even exceeded the performance of the evaluated characters of the comparison varieties, especially the ideal characters expected from the peanut crop. The best potential lines based on harvest age, dry pod weight and productivity are G100, G41, G21, G205, and G84. Heritability values of the evaluated genotypes were in the range of 32.84% - 99.92%, or the medium to high category. The characters with high heritability values include plant height, number of branches, flowering age, harvest age, harvest index, wet stover weight, fresh pod weight, number of filled pods, number of empty pods, percentage of filled pods, and weight of 100 seeds.

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