EVALUATION OF GENETIK PURITY ON 20 GENOTYPES OF BAMBARA GROUNDNUT (*Vigna subterranea* L. Verdcourt) SELECTED FROM SINGLE SEED DESCENT MORPHOLOGICAL CHARACTERS

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ABSTRACT

Bambara groundnut (*Vigna subterranea* L. Verdcourt) is a leguminous plant that originate from African and has been cultivated in others Countries. In Indonesia, especially in Bogor (West Java), it is known as “Kacang Bogor”, while in Gresik (East Java) it is known as “Kacang Kapri”. Important issue in development of Bambara Groundnut local lines was a genetic diversity, so that they need to be purified in order to develop a new variety or as a parent crosses. This research was conducted in research station of Agricultural Faculty, Brawijaya University, in Jatikerto Village, Malang Regency on May until September 2014 and using single plant method so the observation was due to all individual plant. Material in this research was 20 genotypes of bambara groundnut by single seed descent. The result showed five population in genotypes CCC 1.4.1, SS 2.2.2, GSG 1.5, BBL 10.1 and CCC 1.1.1 have each a similarity coefficient more than 0,80 and 15 genotypes had a similarity coefficient less than 0,80, it can be continued with the second selection of *Single Seed Descent*. The character of days of first flowering and harvest age in 20 genotype had a low variability, while in number of flower character, number of pods per plant and fruit set, it had a low, medium and high variability. Genotype BBL 10.1 and GSG 1.5 have a similarity coefficient more than 0,80 and have potential on yield components which is based on early maturity, high number of pods per plant and high fruit set.

Keywords : Bambara groundnut, Genetic purity, Variability.

INTRODUCTION

Bambara groudnut (*Vigna Subterranea* L. Verdcourt)is a leguminous from Afrika and now this plant hasbeen cultivated in other countries. Bambara groundnut is available to growth in Indonesia, but lack of distribution areas.In Indonesia, especially in Bogor (West Java) it is known as “ Kacang Bogor”, while in Gresik (East Java) it is known as “Kacang Kapri” (Kuswanto *et al*., 2012). Bambara groundnut have a high nutrient contents. It contains of 20.75% protein, 59.93% carbohydrate, 5.88% fat, 10.43% water and 3.03% ash (Hidayah *et al*., 2005). This plants are more adaptive and drought tolerant in low fertility soil (Kuswanto *et al*., 2012 and Basu *et al*., 2007). This plant is able to fixed nitrogen in soil through a symbiosis with Rhizobium bacteria,like the other leguminous (Ntundu *et al*., 2003). Self pollination on bambara groundnut is supported by flower structure and included in cleistogamy pollination type. As a self-pollinated crop, the population of bambara groundnut may consists of numerous homozygous pure lines (Heller *et al*., 1997).

Important issue to development the local lines of Bambara Groundnut was genetic diversity. There is some characters that showed diversity in one lines, such as seed color, seed shape or growth habit. The differences of its qualitative character showed a different genetic trait (Kuswanto *et al*., 2012).

The material of this research based on a same seed color between parent and progenies that were selected by single seed descent, than it was sowed and observed of qualitative and quantitative characters. Previous research showed that bambara groundnut was self-pollinated plant and expected has a low variability.

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MATERIAL AND METHODS

This research was conducted in research station of Agricultural Faculty, Brawijaya University, in Jatikerto Village, Kromengan Subdistrict, Malang Regency. This research was conducted on May until September 2014. Material used in this research was 20 genotypes bambara groundnut by single seed descent. Tools that used in this research were polybag, hoe, sprayer, signs, labels, rulers, markers, RHS color chart, paper bags and digital camera. Research was using single plant method and observation was due to all individual plant, each genotype consists of 20 plants, thus entirely contains 400 plants.

Observation on quantitative and qualitative characters of every individual plant was done following the IPGRI (International Plant Genetic Resources Institut) descriptors for bambara groundnut (2000). Qualitative characters were growth habit, terminal leaflet shape, color of terminal leaflet, pigmentation on hypocotyls, pigmentation on flower, stem hairiness, pod shape, pod color, pod texture, seed shape, and seed color. While Quantitative characters were days of the first flowering, number of flowers per plant, age harvest, number of pods per plant and fruit set.

Data analysis of qualitative characterwas using cluster analysis based on *Simple Matching Coefficient*. Dendogram was constructed using *Unweightted Pair-Group Method with Arithmetic* (UPGMA) through *Multivariate Statistical Package* (MVSP) versi 3.1 program. Data analysis of quantitative character was using evaluation of variability by strains the average, variance and coefficients of variability.

RESULT AND DISCUSSION

Twenty genotypes of bambara groundnut had similarity coefficient about 0,702 – 1,000 (Table 1). Five genotypes of bambara groundnut (CCC 1.4.1, SS 2.2.2, GSG 1.5, BBL 10.1, and CCC 1.1.1) had similarity value more than 0,80. The higher the similarity coefficient, the more uniform the plants character of a genotype so that it was pure genetically. According to Pandin (2010) the degree of similarity which used genetic matrix can be divided into four categories: very close resemblance (very good) $r > 0.9$; good $0.8 < r < 0.9$; less good $0.7 < r < 0.8$; bad $r < 0.7$. The level of genetic similarity of a population can be described by a genetic distance from individual members of the population. The closer its genetic distance between individuals in a population, so the more uniform population, the farther its genetic distance of individuals in a population, so the population has become increasingly diverse.

There was a difference in seed color character. For example in genotype CCC 1.1.1 plant number 3 with early planted seed color was black, but the progenies had seed with brown reddish color 11,11%, black 44,44%, brown 5,56% and dark purple 38,89%. Previous research on genotype of bambara groundnut showed that there was differences between progenies and parents. For example CCC 1.1.1 lines had black color of seed. The progenies of this line had seed with cream color (1.31%), brown (4.34%), black (59.57%), black with brown spots (10.56%), dark brown (11.86%) and dark purple (12.36%). This could happen because there was segregation of heterozygous genotype. Color seed of quantitative character was not influenced by environment but controlled by single gene (Nuryati *et al*., 2014).

The difference in seed color on bambara groundnut also found in other research, such as Zembabwe Red (Africa), the seeds were quite uniform in color, with a low segregation into different red color. After three evaluation seasons, it showed less segregation in seed color. There were also black seed color in Garborone Black (Africa), it segregated into other color, especially brown and the the most common seed color is black and brown on a single pod (Heller *et al*., 1997). The same thing was described by Ouedraogo *et al.,*(2008), there was segregation seed color in progenies, farmers in Burkina Faso who used seeds from prior plantation period, stated that the color of seed change year by year.

Table 1 Similarity Coefficient and Coefficient Variabilityon 20 Genotype Bambara Groundnut

No	Genotip	Similarity Coefficient	Coeffient Variability (%)				
			DF	NF	HA	NP	FS
1	CCC 1.4.1	0,807 – 1,000	9.42	47.07	5.89	64.57	41.71
2	GSG 3.1.2	0,783 – 1,000	9.16	34.45	6.26	29.81	22.31
3	JLB1	0,715 – 1,000	5.30	34.03	6.93	39.02	33.48
4	GSG 2.5	0,760 – 1,000	8.96	19.60	6.25	52.19	46.32
5	SS 2.2.2	0,832 – 1,000	7.03	58.56	4.29	54.42	41.01
6	PWBG 5.3.1	0,702 – 0,957	11.84	32.41	6.08	38.00	32.59
7	GSG 1.5	0,814 – 1,000	12.79	23.29	6.16	24.53	18.25
8	BBL 10.1	0,825 – 1,000	10.52	30.28	6.12	32.30	27.25
9	CKB1	0,781 – 1,000	12.24	35.88	5.49	44.35	35.99
10	GSG 1.1.1	0,746 – 1,000	6.38	53.03	7.46	59.48	63.47
11	PWBG 7.1	0,761 – 1,000	6.87	27.82	6.51	38.05	26.48
12	PWBG 5.1.1	0,720 – 0,957	10.73	61.16	6.05	51.82	37.73
13	BBL 6.1.1	0,709 – 1,000	9.39	44.33	6.30	63.13	44.75
14	BBL 2.1.1	0,756 – 0,957	11.33	31.02	5.91	42.21	46.08
15	PWBG 3.1.1	0,764 – 0,957	6.12	49.94	7.27	64.24	67.90
16	CCC 2.1.1	0,743 – 0,957	5.22	47.75	6.16	45.80	49.99
17	CCC 1.1.1	0,808 – 1,000	9.77	36.65	7.53	53.62	55.96
18	TKB1	0,793 – 1,000	8.39	38.69	6.54	54.47	39.10
19	GSG 2.1.1	0,704 – 0,957	9.26	65.07	7.69	67.32	51.24
20	GSG 2.4	0,750 – 1,000	12.45	50.52	5.75	66.95	56.53

Notes : DF (Days of first flowering), NF (Number of flowers), HA (Harvest age), NP (Number of pods per plant), FS (Fruit set).CV (low: 0-25%), (medium: 25-50%), (high: 50-75%), (very high: 75-100%).

The evaluation of variability in genotype was done by coefficients variability in each quantitative character (Table 1). According to Nugroho *et al*., (2013) quantitative character is controlled by polygen and each gene contributes little portion to phenotype. Quantitative trait relatively have a larger environmental component then genetic component.

The coefficient of variability in days of first flowering and harvest age character had a low criteria (CV 0 – 25%). Average of days of first flowering on 20 genotype of observed bambara groundnut,was ranged between 42,67 – 53,40 DAS (Day After Sowing) and coefficient of variability was ranged between 5,22 – 12,79%. Average of harvest age on 20 genotype of observed bambara groundnut was ranged between 100,75 – 122,23 DAS. The coefficient of variability in harvest age character on 20 genotype of bambara groundnut was ranged between 4,29 – 7,69%. Previous research of Nuryati *et al.,* (2014) showed that the average of days of first flowering is 47 DAS and average of harvest age is 128 DAS on local genotype of bambara groundnut. According to Shaumi *et al.,* (2011),if the variability is low, so selection have to be more strict in order to achieve desired genotype uniformity on that character because the individual of its population is relatively uniform.

The number of flowers character on 20 genotype of bambara groundnut had coefficient variability was ranged 19,60 – 65,07%. From the 20 genotypes, 2 genotypes are GSG 2.5 and GSG 1.5 had a low coefficient variability, 13 genotypes had a medium coefficient variability and 5 genotypes (SS 2.2.2, GSG 1.1.1, PWBG 5.1.1, GSG 2.1.1 and GSG 2.4) had a high coefficient variability. The coefficient of variability in number of pod per plant character on 20 genotypes of bambara groundnut was ranged 24,53 – 67,32%. From the 20 genotypes, 1 genotype, GSG 1.5 had a low coefficient variability, 8 genotypes had a medium variability and 11 genotypes had a high coefficient variability. The coefficient variability of fruit set character in 20 genotypes of bambara groundnut was ranged 18,25 – 67,90%. From the 20 genotypes, 2 genotypes (GSG 1.5 and GSG 3.1.2) had a low coefficient variability, 13 genotypes have medium variability and 5 GSG 1.1.1, PWBG 3.1.1,

CCC 1.1.1, GSG 2.1.1, and GSG 2.4) genotypes have high coefficient variability.

Number of flower, number pod per plant, and fruit set had low, medium and high criteria of variability coefficient on 20 genotypes of bambara groundnut. According to Rozika *et al*., (2013),the low to medium value of variability coefficient shows a uniformity in those plant. Nazari (2010) added that high value of variability coefficient shows a large variety traits of the population. According bambara groundnut research of Massawe *et al*., (2005), there is a variance between vegetative and reproductive traits between but there was no high correlation between vegetative and reproductive development in bambara groundnut. Shaumi *et al*., (2011), the high variability shows a diversity in plant character, so it still needs a selection of superior character to achieve uniform population.

The selection of quantitative character on 20 genotypes of bambara groundnut which had yield components potential is based on early maturity, high number of pods per plant and high fruit set in genotype GSG 3.1.2, JLB1, BBL 10.1, GSG 1.5, and PWBG 7.1. The other research based on consumer survey, selection criteria for bambara groundnut are early maturity, high yield, large seed (Massawe *et al*., 2005; Karikari, 2000 and Jonah *et al*., 2013). Following the research of Oyiga *et al*., (2011),the primary component of bambara groundnut yield are number of pods per plant and seed weight. Seed weight shows correlation with number of flower per plant and number of pod per plant. (Jonah et al., 2010 and Jonah 2011) Study of correlation in character which have a high yield is more effective for selection of superior genotypes.

CONCLUSION

Five population in genotypes CCC 1.4.1, SS 2.2.2, GSG 1.5, BBL 10.1, and CCC 1.1.1 had each a similarity coefficient more than 0,80 and 15 genotypes had a similarity coefficient less than 0,80, so it can be continued with the second selection of *Single Seed Descent*. The coefficient of variability in days of first flowering (CV 5,22% – 12,79%) and harvest age (CV 4,29% – 7,69%) character had a low criteria, while number of flower (CV 19,60% – 65,07%), number of pod per plant (CV 24,53% – 67,32%) and fruit set (CV 18,25% – 67,90%) character had low, medium and high criteria of coefficient variability on 20 genotypes of bambara groundnut. Genotype BBL 10.1 and GSG 1.5 have a similarity coefficient more than 0,80 and have potential on yield components which is based on early maturity, high number of pods per plant and high fruit set.

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