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PHENOTYPE CHARACTERISTICS OF CROSSING PURPLE CORN AND SWEET YELLOW CORN (ZEA MAYS L.) IN GENERATION F4

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ABSTRACT

Phenotypic characters in crossed plants is very important to find out the success of a cross and the differences in characters between one type and another. The purpose of this study was to identify and determine the best phenotypic characters resulting from crosses of maize plants in the F4 generation. This research was carried out on agricultural land in Oloboju Village (Bulu Pontu Jaya SP2), at an altitude of 176 meters above sea level, with a latitude of 1°00'21" South Latitude and 119°56'50.49" North Latitude. Sigi Biromaru District, Sigi Regency. The study started from February to July 2020. This study was structured using a randomized block design with five maize cultivars from F3 crosses as treatments, namely: purple corn cultivar, dominant yellow: purple, white dominant purple, purple dominant white, and purple dominant yellow which was repeated five times to obtain 25 experimental plots. The observed variables were: plant height, number of leaves, stem diameter, age at which male flowers were released, age at which female flowers were released, age at harvest, cob length, cob diameter, number of cob seeds, percentage of color, and weight of 100 seeds. The research data were analyzed using ovarian analysis, which was followed by the HSD test at the 1% level. The results showed that purple corn cultivars had the best phenotypic characteristics, namely, plant height reached 226.55 cm, cob diameter reached 40.95 mm, cob length reached 15.05 cm, color percentage reached 70.39%, number of cob seeds reached 411 .70 seeds and has a slightly fluffier texture and a slightly less sweet taste until it is quite sweet.

Keywords: Corn Crosses, F4 Generation, Phenotypic Characters.

INTRODUCTION

Corn is the main food for Indonesian people after rice and sago and several types of corn are consumed and processed, such as sweet corn, yellow corn, and purple corn (purple corn). Sweet corn (yellow carnal) has the advantage of a

sweet taste caused by the high carbohydrate content in the seeds. Purple corn (purple carnel) contains high levels of anthocyanins and is good for health (Mustakim et al., 2020).

The combination of crosses carried out on the two corns is beneficial for the maize breeding program, especially if it is directed to obtain a variety of color characters with a combination of anthocyanin levels and a sweet taste (Maulidha and Sugiharto, 2019).

Character information on crossed plants is very important to know, because this information can be used as a conclusion whether the crossing that we are doing is successful or not and also to know the extent to which these characters can be passed on to the next generation. Information about the phenotypic characters is very important to know in order to determine the differences in the characters of the several types of maize used in the crosses. For this reason, it is deemed necessary to study the "Phenotypic Characters of Crosses of Purple Pulut Corn and Sweet Yellow Corn (Zea mays L.) in the F4 Generation" to identify and determine the best phenotypic characters resulting from crossing corn plants in the F4 generation.

RESEARCH METHODS

This research was carried out on agricultural land in the village of Oloboju (BuluPontu Jaya SP2), at an altitude of 176 masl, with a latitude of 1°00'21" South Latitude and 119°56'50.49" North Latitude. Sigi Biromaru District, Sigi Regency. The research starts from February to July 2020. The tools used in this study were hoes, machetes, buckets, hoses, sprinklers, tape measure, caliper, sprayer, camera, mortar, and writing tools. Meanwhile, the materials used were NPK Mutiara 16:16:16 fertilizer, insecticides, and five maize cultivars from F3 crosses.

This study was arranged using a randomized block design (RBD) with five maize cultivars from F3 crosses as the treatment which was repeated five times to obtain 25 experimental plots. The treatments given were five types of maize resulting from crosses in different F3 generations, namely: purple maize cultivars, purple dominant yellow, white dominant purple, purple dominant white, and yellow dominant purple.

The observed variables were: plant height, number of leaves, stem diameter, age at which male flowers were released, age at which female flowers were released, age at harvest, cob length, cob diameter, number of cob seeds, percentage of color, and weight of 100 seeds. The research data were analyzed using ovarian analysis (ANOVA), which was followed by the HSD test at the 1% level.

RESULTS AND DISCUSSION

The results of the 1% BNJ test showed that the dominant purple and yellow corn cultivars had the highest average plant height, namely 226.55 cm, and were not significantly different from the white dominant purple corn cultivars. The dominant white purple corn cultivar had the highest average number of leaves, namely 10.45 leaves, but was not significantly different from the purple corn cultivar.

The dominant yellow-purple corn cultivar had a larger stem diameter of 20.73 mm, but it was not different from the purple and yellow dominant corn cultivars. The yellow dominant purple cultivar had a faster male flower release age of 54 hst, however, it was not different from the white dominant purple and purple dominant yellow cultivars. The purple dominant yellow cultivar produced a shorter female flower release age of 55.80 dap, but this was not significantly different from the white dominant purple and yellow dominant purple cultivars.

The purple dominant yellow cultivar had a faster harvesting age of 100.80 hst, but not significantly different from the yellow dominant purple cultivar. The purple corn cultivar had a larger cob diameter of 40.95 mm, a longer cob length

of 15.05 cm, a higher number of cob seeds 411.70 seeds and a higher color percentage of 70.39% and was significantly different from the cultivars that were other variables on cob diameter, cob length, and color percentage, while the number of cob seeds was not significantly different from the dominant purple cultivar white. The dominant yellow-purple corn cultivar has a heavier 100-seed weight of 19.90 grams and is significantly different from the other cultivar.

Table 1. Effect of phenotypic character treatment on corn growth.

Treatment	Observed Variables				
	TT (cm)	JD	DB	UKBJ	UKBB
Purple	226,55[b]	9,80[b]	18,30[b]	59,60[b]	63,00[b]
Yellow dominant purple	226,55[b]	8,15[a]	20,57[c]	56,00[a]	55,80[a]
Purple predominately white	206,30[a]	10,45[b]	16,39[a]	57,68[ab]	60,15[ab]
White predominately purple	221,69[ab]	8,25[a]	19,77[bc]	59,00[b]	63,20[b]
Purple dominant yellow	224,92[b]	8,42[a]	20,73[c]	54,00[a]	57,80[a]
HSD 1%	16,68	1,21	1,89	4,68	5,05

Information: TT (plant height), JD (number of leaves), DB (stem diameter), UKBJ (age of male flower release), UKBB (age of female flower release).

Table 2. Effect of phenotypic character treatment on corn yield.

Treatment	Observed Variables					
	UP	DT	PT	JBPT	%	100
Purple	108,00[b]	40,95[b]	15,05[b]	411,70[c]	70,39[c]	17,92[b]
Yellow dominant purple	100,80[a]	38,70[a]	14,55[a]	330,05[b]	22,58[b]	18,90[b]
Purple predominately white	108,00[b]	38,28[a]	13,95[a]	403,30[bc]	4,98[a]	17,44[a]
White predominately purple	108,20[b]	36,19[a]	12,91[a]	273,31[a]	16,91[ab]	13,46[a]
Purple dominant yellow	102,80[a]	37,03[a]	13,88[a]	254,17[a]	5,22[a]	19,90[c]
HSD 1%	6,22	3,22	1,87	80,39	15,60	5,77

Information: UP (harvest age), DT (cob diameter), PT (cob length), JBPT (number of seeds per ear), % (color percentage), and 100 (100 seed weight).

Table 3. Effect of phenotypic character treatment on texture and sweetness level of corn

Treatment	Texture	Sweetness Level
Purple	Rather fluffier	Less sweet and quite sweet
Yellow dominant purple	Not fluffier, rather fluffier and fluffier	Sweet
Purple predominately white	Rather fluffier and fluffier	Pretty sweet and sweet
White predominately purple	Rather fluffier and fluffier	Pretty sweet and sweet
Purple dominant yellow	Rather fluffier	Very sweet

Note: the data is generated from 25 correspondents

The results of the taste test showed that the purple corn cultivar had a texture: slightly fluffier and, a level of sweetness: of less sweet and moderately sweet. Yellow corn cultivar with purple predominance produces textures: not fluffier, slightly fluffier and fluffier, level of sweetness: sweet. The dominant white-purple corn cultivar produces a texture: that is rather fluffier and fluffier, a level of sweetness: moderately sweet. Purple dominant white corn cultivars produce texture: slightly fluffier and fluffier, level of sweetness: moderately sweet and sweet. The dominant yellow purple corn cultivar has a texture of: fluffier and a level of sweetness: very sweet.

Discussion

Based on the results of the study, it was shown that the appearance of the characters of maize from crosses in the F4 generation, of the five cultivars used had a very significant effect on all the variables used. This is because each maize cultivar resulting from crosses in the F4 generation has a different genetic structure which causes different phenotypic characters to be observed.

The diversity of traits in a population is caused by the genetic diversity of the same environment, then the magnitude is measured and expressed as the variance. Genetic diversity is a difference caused by differences in genotypes in the population. The phenotypic diversity that occurs is the result of genetic diversity and environmental diversity, (Samudin, et al., 2021; Jeki, et al., 2021; Andriani, et al., 2015).

Identification of the phenotypic characters of maize in the F4 generation showed that the plant height, and stem diameter obtained were high and the number of leaves was large. The character of plant height and number of leaves is positively correlated with the ability of plants to absorb more sunlight and the number of leaves greatly affects the process of photosynthesis, because the process of photosynthesis occurs in leaf chlorophyll. According to (Lubis, et al., 2013), high enough plant height will result in maximum absorption and absorption of sunlight which will be followed by optimal absorption of nutrients so that the photosynthesis process is more optimal.

The phenotypic characteristics of maize in the F4 generation had the character of cob length, cob diameter, and the number of seeds per cob, where these characteristics were closely related to yield. The longer the cob, the larger the diameter of the cob, and the greater the number of seeds per cob, the greater the yield obtained and vice versa, if the corn cob is short, the cob diameter is small, and the number of seeds per cob is less, the yield will also decrease. The results of the study (Yuwono and Purwito, 2015) found that the character of cob length and ear diameter had a high direct effect on ear weight.

The results of the study (Subaedah, et al., 2016), found that the yield was higher due to the longer cobs. (Abdalla, et al., 2010), also found that yield has a significantly positive correlation coefficient with harvested dry cob weight. (Al-Naggar, et al., 2016), found that the yield component has a strong correlation with yield power.

The appearance of the characters at the time of release of male and female flowers is very closely related to the age of harvest of corn plants. There is a difference in the age at which male flowers come out, the age at which women flowers come out and the age at which they are harvested is influenced by genetic factors, which is why each cultivar has a different age when it comes out of male flowers, when it leaves female flowers and when it is harvested.

The results of the study (Garba and Namo, 2013) found that the growth and production of several varieties of corn and concluded that the growth of maize aged longer, but early maturing maize flowered faster. Like wise the results of a study (Bello, et al., 2012) that evaluated medium-aged and early-mature maize varieties under optimal rainfall conditions

suggested that deep- and medium-aged varieties respectively gave higher yields of 34.29% and 17% compared to with early maturing varieties; However, early maturing varieties flower faster, making it possible to develop them in areas experiencing prolonged drought stress.

The results of the study (Mustakim, et al., 2020) found that in the F3 generation, the percentage of purple was 69.51%, the dominant yellow color was purple at 19.97%, the dominant purple color was yellow at 27%, the color yellow was 68.14%, white color 74.22%, purple dominant white color 6.84%, white dominant purple color 2.52%, and wrinkled character decreased by 14.75%.

From the results of previous studies it can be seen that the purple corn cultivar produced a purple proportion of 69.51%, then the F4 generation produced an increased and higher proportion of the color, namely 70.39%, compared to other corn cultivars. This indicates that the purple corn cultivar is the cultivar that achieves color uniformity or homozygous characters more quickly than other cultivars because this trait is the dominant character that emerges from the results of crosses. The results of the study also show that there is a variety of colors that appear in the F4 generation. This shows the success of a cross that was carried out because the color that appears is due to the combination of the colors of the two heads, namely purple and sweet yellow glutinous corn.

The results of the study (Pamandungan and Ogie, 2018) found that the percentage of the number of yellow seeds and the type of Flint seeds, which are yellow Manado maize characters, was obtained from crosses between Flint X Dent.

The sensory test results of the five corn cultivars tested using 25 respondents produced a slightly fluffier to fluffier texture and a less sweet to very sweet taste. This is because these characters are derived from the two parental characters, namely purple glutinous corn, and sweet yellow corn, and the presence of the parent characters in their offspring proves the success of a cross. The results of the study (Pudjiono and Na'iem, 2005) found that crossing different female and male parents produced different heterosis and not all of them could produce heterotic F1.

The success of a cross can be seen from the character of the two parents found in the offspring. Crosses that show the highest heterosis value are the best. The heterosis values passed on to the next generation are the result of gene expression of the two parents which are inherited and combined through crossing, (Arif, et al., 2012; Ujianto, et al., 2012).

CONCLUSION

Purple corn cultivars had the best phenotypic characteristics, namely, plant height reached 226.55 cm, cob diameter reached 40.95 mm, cob length reached 15.05 cm, the color percentage reached 70.39%, the number of cob seeds reached 411.70 seeds and a rather fluffier texture and a slightly less sweet taste until it is quite sweet.

Suggestion

It is recommended that further research regarding genetic potential and character selection selection in the F4 generation and re-evaluate the results of this cross to obtain stability of the phenotype and genotype characters so that later a new variety will be obtained.

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