

IOP 2020, Analysis of heritability and correlation Wheat Mutans M6 Farid_BDR_2020_IOP.pdf

by

FILE	IOP 2020, ANALYSIS OF HERITABILITY AND CORRELATION WHEAT MUTANS M6 FARID_BDR_2020_IOP.PDF (423.43K)		
TIME SUBMITTED	11-JAN-2021 08:37PM (UTC+0700)	WORD COUNT	2958
SUBMISSION ID	1485735701	CHARACTER COUNT	13881

PAPER · OPEN ACCESS**Analysis of heritability and correlation of agronomic character towards the yield of several m6 generation of wheat mutants (*Triticum aestivum* L.) in the lowlands**

4

To cite this article: M Farid BDR *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **484** 012045View the [article online](#) for updates and enhancements.

Analysis of heritability and correlation of agronomic character towards the yield of several m6 generation of wheat mutants (*Triticum aestivum* L.) in the lowlands

M Farid BDR, Nasaruddin, H Iswoyo, I Ridwan and F Arsyad

Department of Agronomy, Faculty of Agriculture, Hasanuddin University, Jl. Perintis Kemerdekaan KM 10 Makassar 90245, Indonesia.

E-mail: farid_deni@yahoo.co.id

Abstract. This research aims to find out the lowland and high production adaptive M6 generation of mutant wheat, to know the positive correlation between growth parameters and production components on yields, and to determine the parameters that have high heritability. The research was carried out in the Bonto Parang which is located in Kelara Village, Tolo Selatan District, Jeneponto Regency at an altitude of 135 m asl, with coordinates of 5° 24'58.0" LS 119° 54'58.2" BT, Climate type E (2 wet months and 5 months dry) andosol soil type. The research was conducted from July to October 2018. This research used a Randomized Block Design with 16 lines as genetic material resulting from mutations and four varieties (Dewata, Selayar, Nias, and Munal) used as a comparison so that there were 20 genotypes. The research was conducted with 3 replications so that there were 60 experimental units. The results showed that the M6 mutant wheat is adaptive to lowland and it has a high number of products which is N 350 3.8.9 (3.48 tons.ha-1), N 200 2.4.B.6 (3.37 tons.ha-1) and N 300 4.3.6 (2.71 ton.ha-1). Growth parameters and production components that have a significant positive correlation and bring significant results are plant height, number of tillers, productive tillers, number of stomata, stomatal density, chlorophyll index, panicle length, number of spikelet scales, percentage of empty floret, weight of seed scales and of 1000 seeds, high heritability and high genetic diversity followed by the characteristics of productive tillers, number of seedlings, scum production, clump production, production and flowering age.

1. Introduction

Wheat is a multifunctional cereal crop that plays a role in the problem solving of food security in Indonesia. Through the use of wheat crops, the government has other alternatives and is not focused on rice commodities alone. Food diversification program can be implemented using this plant. Wheat is used as raw material for wheat flour which is widely used in making various food products because it is rich in calories and protein. [1] states that wheat as the main ingredient of wheat flour has a distinctive advantage, namely having gluten which can develop the flour-based dough.

While conducting efforts to develop the production of wheat in Indonesia, there is a problem that we should face; high temperature. Climate change causes an increase in air temperature that will threaten food security in the country. This development has begun by conducting multi-location tests of several local and introduced wheat genotypes in several regions in Indonesia. According to [2], the altitude of

the place is divided into three types, namely the lowlands of 0-400 meters above sea level, medium-lands of 400-800 m above sea level and uplands of 800 - 1,200 m above sea level.

Domestic wheat production needs to be supported by the availability of wheat varieties and the application of cultivation technologies that are in line with agro-climate in Indonesia. It is necessary to evaluate and select mutations of wheat lines to obtain wheat that is adaptive to high temperatures based on altitude. Improving plant properties requires genetic diversity. Increased genetic diversity and improved varieties for one or two traits can be done through crossing and induction of genetic mutations [3]. Based on the description, one of the initial steps to obtain wheat varieties that can grow well in the lowlands with high productivity and heritability is to conduct research on the evaluation of several M6 wheat mutant lines in the lowlands.

2. Methodology

The research was carried out in Bonto Parang, which is located in Kelara Village, South Tolo Sub-District, Jeneponto Regency at an altitude of 135 m above sea level, with coordinates of 5° 24'58.0" LS 119° 54'58.2" East. Climate type E (2 wet months and 5 dry months) with an average temperature of 28-30 °C, 95-96% humidity, 82-98% radiation, 26-67 mm rainfall and andosol soil type. The research was conducted from March to June 2018.

The materials used in this research were 16 genotype wheat seeds and 4 comparative varieties, namely Dewata, Selayar, Nias, and Munal. The study design used a randomized block design (RBD) with 3 replications. Data obtained from observations were analyzed using one-way ANOVA according to the RBD. The level of testing was also analyzed using heritability analysis to see the diversity of genotypes that affect each observed parameter. Heritability values obtained were classified into three according to [4], namely high ($h^2 > 50\%$), moderate ($20\% < h^2 < 50\%$), and low ($h^2 < 20\%$). Observed variables were plant height (cm), stomata number, panicle length (cm), percentage of empty florets and production per hectare. Production per hectare is calculated by:

$$\frac{\text{Area per hectare (m}^2\text{)}}{\text{Plot area (m}^2\text{)}} \times \text{Seed weight per plot (kg)}$$

3. Result and Discussion

3.1. Growth and production parameters

LSD test results Table 1 show that N 200 2.4.B.6 (g12) produced the highest plant height (61.57 cm) and was significantly different from all comparator varieties. The stomata parameter shows that N 200 2.4.B.6 (g12) and N 300 4.3.6 (g16) have the most stomata (10.33) and are significantly different from all comparative varieties. Genotype N 350 3.1.3 (g4) has the highest panicle length (8.50 cm) and is significantly different from the comparative varieties of Nias (c) and Munal (d). The percentage of empty florets shows that N 200 2.4.B.6 (g12) has the fewest percentage (49.85%) and is significantly different from the comparative varieties Selayar (b). Whereas, the production shows that N 350 3.8.9 (g9) has the most production (3.48 t.ha⁻¹) and is significantly different from all comparator varieties. The results of the study by [5] showed that lines affected several morphological characters of wheat plants, one of which was the percentage of empty florets.

Table 1. Average Plant Height (cm), Number of Stomata, Panicle Length (cm), Percentage of Empty Floret (%) and Production (ton.ha⁻¹).

Genotype	Plant Height	Number of Stomata	Panicle Length	Percentage of Empty Floret	Production					
g1 (M 200 1.7.1)	45.77	7.33	7.38	61.34	1.82					
g2 (N 350 3.14)	48.67	8.78	7.52	60.28	2.09					
g3 (N 250 4.2.1)	58.53	abcd	7.56	7.88	65.61	1.90				
g4 (N 350 3.1.3)	57.90	abcd	8.55	8.50	^c _d 52.85	2.67	d			
g5 (N 350 3.2.2)	49.53		9.44	8.16	d 52.29	2.46				
g6 (N 250 4.5.2)	53.07	d	7.89	7.77	51.36	b	1.86			
g7 (N 350 3.1.4)	59.00	abcd	7.78	7.93	51.95		1.82			
g8 (N 250 4.6.2)	56.13	d	9.00	8.21	d 51.94		2.48	d		
g9 (N 350 3.8.9)	59.67	abcd	9.33	8.28	d 63.83		3.48	abcd		
g10 (N 250 4.4.2)	52.93	d	8.78	7.57	50.13	b	2.19			
g11 (N 350 3.5.10)	49.83		8.56	7.37	55.61		1.05			
g12 (N 200 2.4.B.6)	61.57	abcd	10.33	^{abc} _d	8.33	d	49.85	b	3.37	abcd
g13 (S 8.4.2)	51.83	d	8.00	7.33	61.81		1.96			
g14 (N 200 2.5.2)	53.93	d	7.55	7.26	50.75	b	2.19			
g15 (N 200 2.3.3)	50.00		8.00	7.62	60.94		1.54			
g16 (N 300 4.3.6)	54.17	d	10.33	^{abc} _d	8.29	d	59.17		2.71	d
g17 (Dewata) (a)	49.67		8.33	8.00	55.80		2.40			
g18 (Selayar) (b)	50.20		8.22	7.70	61.76		2.16			
g19 (Nias) (c)	48.17		8.00	7.64	56.30		2.02			
g20 (Munal) (d)	43.17		8.11	7.35	58.84		1.70			
NP LSD (0,05)	8.08		1.74	0.81	10.23		0.77			

Numbers followed by the same letters in columns (a,b, c, d, e) means that they are not significantly different at the LSD test level=0.05.

3.2. Heritability value

Table 2 shows that all observed characters, including the vegetative, generative, and production components, have low, moderate to high heritability values based on the index value of each character. Based on the results of the heritability analysis in table 2, it shows that there are one parameter has a high heritability value, three parameters have a moderate heritability value and one that has low heritability value.

The growth of M6 wheat mutants in the lowlands shows quite good results. The growth and production of wheat are greatly influenced by the suitability of the environment in which the wheat is grown. This is in line with what was stated by [6] that several environmental factors that could affect the growth of wheat plants are rainfall, temperature, light intensity, and humidity.

Table 2. Heritability values in some M6 wheat mutant lines

No.	Character	h ² value (%)	Note
1.	Plant Height	40.52	medium
2.	Number of Stomata	24.10	low
3.	Panicle Length	23.25	medium
4.	Percentage of Empty Floret	24.61	medium
5.	Production	54.03	high

0 < h² ≤ 20 (low), 21 < h² ≤ 50 (medium), 50 < h² ≤ 100 (high)

The average height of wheat plants produced is classified as short to moderate because the range obtained is 48.91 - 72.04 cm. This is in accordance with the opinion of [1] who grouped wheat plants into short categories for plants with a range (53.5 - 65.2 cm), moderate (65.2-76.9 cm), and height (> 76, 9 cm). The parameters of the number of stomata (10.33) and stomata density (51.42 per cm²). Elevation <400 m above sea level indicates the physiological parameters in the treatment of wheat genotypes have a different effect than in the medium to high altitude.

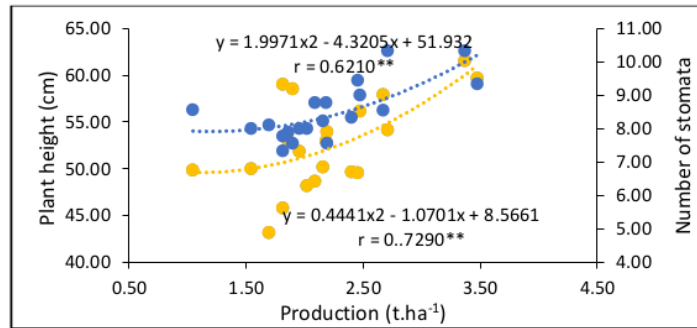


Figure 1. Relationship between plant height (cm) and number of stomata with production (ton.ha⁻¹), r18 (0,444; 0,561).

This is consistent with the statement of [7] that panicle length is a parameter that supports high and low productivity. The longer the panicle size, the greater the chance of the amount of grain being formed. The percentage of empty florets showed that N 200 2.4.B.6 (g12) had the least number of empty floret compared to the two comparison varieties (49.85%). The sterilized floret cannot be separated from the influence of high temperatures which causes the amount of wheat flour to increase. This is in accordance with [8] which stated that temperatures that are too low or too high result in the number of single flowers (floret) that are sterile or infertile so that fertilization cannot occur. [9] added that the cultivation of wheat in medium dry land has a problem where the temperature is higher so that wheat production is not optimal even plants can be affected by stress.

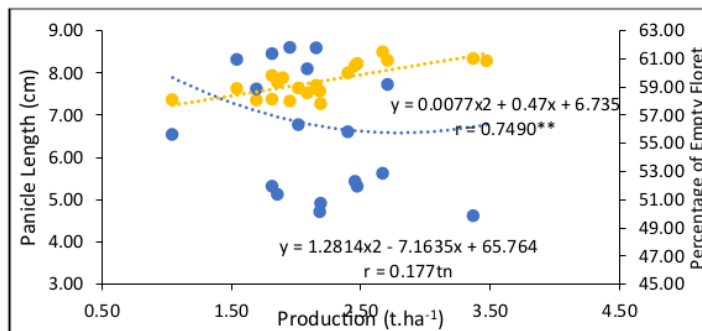


Figure 2. Relationship between panicle length (cm) and percentage of empty floret with production (ton.ha⁻¹), r18 (0,444; 0,561).

Air temperature (maximum and minimum) in wheat plants is a factor that determines the high and low production of wheat. Based on the appendix table 17 shows that the air temperature at the study site is a minimum temperature of 28.6 °C and a maximum temperature of 30.9°C with the highest production produced by genotype N 350 3.8.9 (g9) namely (3.48 tons.ha⁻¹). The level of air temperature in an area affects the productivity of wheat the higher the temperature of the wheat the productivity of wheat decreases. However, there are several areas in Indonesia that have lower temperatures in the lowlands at certain periods that will affect in increasing productivity. This is in accordance with [10] which stated the productivity of wheat has a close relationship with the temperature of the air to a degree Celsius increase in average air temperature, grain yield will decrease by 504 kg / ha.

Heritability analysis is a quantitative benchmark to determine whether the differences in the phenotype of a character are caused by genetic or environmental factors, so that it can give an idea whether the characters observed are more influenced by genetic or environmental factors. The character that has the highest heritability is only Production (54.03%). [11] suggests that characters with high heritability will increase the effectiveness of selection in endurance testing because the observed characters are a reflection of the influence of genetic factors compared to environmental influences. Quantitative characters that have high heritability will produce a progress of selection for desirable traits, means the lower heritability is less effective to be used as selection material.

4. Conclusion

Adaptive wheat mutants of lowland M6 generation and high in productivity are N 350 3.8.9 (g9) (3.48 tons.ha⁻¹), N 200 2.4.B.6 (g12) (3.37 tons.ha⁻¹) and N 300 4.3.6 (g16) (2.71 tons.ha⁻¹). Growth parameters and production components that have a significant positive correlation to very significant results are plant height, number of tillers, productive tillers, number of stomata, stomatal density, chlorophyll index, panicle length, number of spikelet scales, number of empty florets, seed weight and weights 1000 seeds. The estimated value of high heritability and genetic diversity is followed by the characteristics of productive tillers, the number of seedlings, clump production, production, and flowering age.

References

- [1] Budiarti S G 2005 Karakterisasi beberapa sifat kuantitatif plasma nutfah gandum (*Triticum aestivum* L.) *Buletin Plasma Nutfah* **11** (2) 49-54.
- [2] Hendro S 2008 Berkebun 21 Jenis Tanaman Buah (Jakarta: Swadaya).
- [3] Witjaksono 2003 Bioteknologi Untuk Perbaikan Tanaman Buah (Bogor: Pusat Penelitian Biologi, LIPI).
- [4] Elrod S L dan William D S 2006 Genetika (Jakarta: Erlangga).

- [5] Mardiana Y, Yudiwanti W EK, Trikoesoemaningtyas, dan Amin N 2016 Keragaan dan Seleksi Galur F5 Gandum (OASIS x HP1744) di Dataran Tinggi *J. Hijau cendikia* **1** (1) 43-54.
- [6] Wiyono T N 1980 Budidaya Tanaman Gandum (Jakarta: PT. Karya Nusantara).
- [7] Nita K, Bayu P W, Yuni W, Indrastuti A R, dan Satoto 2016 Korelasi dan sidik lintas karakter agronomi padi hibrida *J. Ilmu Pertanian Indonesia* **21** (2) 76-83.
- [8] Simmons S R, Oelke E A, and Anderson P M 1985 Growth and Development Guide For Spring Wheat (MN: University of Minnesota Agricultural Extension Service).
- [9] Wicaksono F Y, Aep W I, Agus W, dan Setianingrum L W 2015 Pertumbuhan dan hasil gandum (*Triticum aestivum* L.) yang diberi asam salisilat dan kalsium klorida dengan selang waktu yang berbeda di dataran medium Jatinagor *J. Kultivasi* **14** (2) 29-35.
- [10] Aggarwal P K 1991 Simulating growth, development, and yield of wheat in warmer areas p 429-446 In Saunders, D A (ed) *Wheat for Non-Traditional Warm Area Proc.of the International Conference, July 29-August 3 1991 Brazil CYMMIT Mexico* D F.
- [11] Basir M 2001 Pemanfaatan nilai heritabilitas dan koefisien korelasi untuk menentukan indikator seleksi *J. Agrivigor* **1** (1) 1-6.

IOP 2020, Analysis of heritability and correlation Wheat Mutans M6 Farid_BDR_2020_IOP.pdf

ORIGINALITY REPORT

% **10**
SIMILARITY INDEX

% **9**
INTERNET SOURCES

% **6**
PUBLICATIONS

% **6**
STUDENT PAPERS

PRIMARY SOURCES

1 Submitted to University of Greenwich
Student Paper % **2**

2 hal-unilim.archives-ouvertes.fr
Internet Source % **2**

3 web.unhas.ac.id
Internet Source % **2**

4 repository.unair.ac.id
Internet Source % **1**

5 Submitted to Universitas Diponegoro
Student Paper % **1**

6 Gribaldi Gribaldi, Nurlaili Nurlaili, Nurmala Dewi, Ekawati Danial, Firnawati Sakalena, Rujito A. Suwignyo. "Modified Application of Nitrogen Fertilizer for Increasing Rice Variety Tolerance toward Submergence Stress", International Journal of Agronomy, 2017
Publication % **1**

7 media.neliti.com

Internet Source

<% 1

8 www.coursehero.com
Internet Source

<% 1

9 www.sci epub.com
Internet Source

<% 1

10 garuda.ristekbrin.go.id
Internet Source

<% 1

11 "Just Enough Nitrogen", Springer Science and
Business Media LLC, 2020
Publication

<% 1

EXCLUDE QUOTES ON

EXCLUDE
BIBLIOGRAPHY ON

EXCLUDE MATCHES < 5
WORDS