Evaluation candidate of test cross hybrid QPM under ecosystem of Polewali Mandar West Sulawesi

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Abstract. Quality Protein Maize (QPM) was specialty maize which is high content of lysine and tryptophan. These are two essential amino acids better nutritional for human body to anticipated of disease (kwashiorkor) on severe among children, and could be corrective use in balancing diets. The experiment on 2018 has been conducted to evaluated of nine candidate test cross hybrid of QPM vs. check Bima 13Q with CRD three replications under lowland in distrit of Polman West Sulawesi. Genetic material were planted in four rows 5.0 m length, spacing 75x20 cm, and applied fertilizer Urea, Ponska (300-200) kg/ha. The result shown that two test cross F1 QPM were (MSQ(S1)C0-26-1-1 x MR14Q) and (MSQ(S1)C0-43-1-1-1 x MR13Q) which the best with potential yield 10.66 -10.95 t/ha. The LSD shown that there are significant different with check Bima 13Q on yield (wc.15%) and highly 30.0% and 31.6%. The two candidates were founded shelling percentage 77.9% and 79.0%, asi less than five days and could be promising as new variety and continuing in evaluation variety trial (evt) in west Sulawesi.

1. Introduction

QPM (Quality Protein Maize) was specialty maize which high lysine and tryptophane in opaque-2 was discovery by Linn Bates on 1963, the opaque-2 mutant still ranks at the top of all viable single mutant, and opaque-2 endosperm also contains a much higher level of nutrition [1, 2]. The essential amino acid with better nutritional for deficiency of disease (kwashiorkor) on severe among children, and could be as food for corrective use in balancing diets [3, 4]. Indonesia was a new country to released QPM. The first released of yellow grain OPV in 2004 from population S99TLYQ-AB with name Srikandi Kuning 1 (Srikandi Yellow 1). The total area was planted in 2020 predicted around 100,000 ha cumulative. The new material of QPM was be generate by intra population improvement by ICERI-Maros has been generated by syntetic POP66C0.QPM.TLYQ [5, 6].

Population to increase of genetic material for selected to evt (evaluation variety trial) in district of Polewali Mandar (Polman) in West Sulawesi (Sulawesi Barat). QPM was important to introduce to the farmers as specialty maize for food crops to improve of health included for poultry and forage. The best population would be promotion new National variety in IND particularly in West Sulawesi. The objective of experiment was to find out of the best genetic F1- test cross hybrid QPM which is hight yield and stable in Polewali Mandar (Polman) Sulawesi Barat (West Sulawesi)..
2. Material and Methode

The experiment was conducted by Randomized Complete Block Design (RCBD) with three replications. There are ten test crossed of QPM-Genotypes (Gi, i:1,2,3...9) include QPM F1 as check (G10. Bima 13Q), tester MR14Q were evaluated under low land in Polman West Sulawesi (<50 m above the sea). The F1material was to test by Statistical analysis used LSD (least significant different) in 95% level of significant [7]. The genotypes were planting in four rows per se., plant spacing 75x20 cm per hole and used lenght of plot 5.0 m, fertilizer applied by Urea and Ponska (300-200) kg/ha, water irrigated in on dry was every 7-10 days. The evt on Februari – April 2018 in village of Paku-Binuang, Polman West Sulawesi in the farmer fields.

The material were evaluated as test cross hybrid QPM:

| Genotype | Crossed with     |
|----------|------------------|
| G1       | CML161-2-1-4-2 x tester |
| G2       | CML165-3-1-2-4 x tester |
| G3       | CML170-1 x tester |
| G4       | CML172-2-1-2 x tester |
| G5       | MSQ(S1)C0-26-1-1 x tester |
| G6       | MSQ(S1)C0-27-1-1-# x tester |
| G7       | MSQ(S1)C0-34-1 x tester |
| G8       | MSQ(S1)C0-43-1-1-1 x tester |
| G9       | MSQ.C0 x tester |
| G10      | Check (Bima 13Q) |

CML (CYMMIT Maize Line) MSQ : Maize Synthetic QPM

The variable were observed like as vegetative growth, plant and ear height, generative stage, asi (anthesis silking interval), cobs component and grain yield in 15% wc. Yield of grain were predicted by:

\[ Y = \left(\frac{10000}{7.5}\right)\left(\frac{100-wc}{85}\right) \times \text{shelling} \times \text{ear weight}, \text{wc : water content of harvested seeds, shelling percentage sample from five ears [8, 9].} \]

3. Result and Discussion

The result analyzed of data to observed could be shown in Table 1. There are three groups under separate of data on: 1) vegetative and periods of tasseling, 2) variable on harvested time and 3) component of yield.

In Table 1 were founded that coefficient of variation (c. v) is less than 20% for all variable and grain yield are 11.87%.

| Variable                          | Block  | Genotypes   | Error  | C. V (%) |
|-----------------------------------|--------|-------------|--------|----------|
| **vegetative and flowering**      |        |             |        |          |
| growth percentage, %              | 27.1000| 227.4815    | 178.2481| 18.63    |
| plant height, cm                  | 1191.6333| 526.9074    | 532.9296| 12.26    |
| ear height, cm                    | 361.8000| 1359.8667   | 4177.5333| 15.06    |
| tasseling, days                   | 0.6000 | 18.8000     | 87.4000 | 5.37     |
| silking, days                     | 6.4000 | 6.1519      | 4.9185  | 4.92     |
| **variable on harvested**         |        |             |        |          |
| weight of 20 ears, kg             | 0.0080 | 0.3055      | 0.1967  | 12.82    |
| weight of 5 ears, kg              | 0.0201 | 0.0447      | 0.0344  | 19.07    |
| seed weight of 5 ears, kg         | 0.0062 | 0.0286      | 0.0221  | 19.54    |
| shelling percentage, %            | 9.4086 | 3.4893      | 3.6004  | 2.91     |
| water content of seeds, %         | 1.2973 | 20.3735     | 1.4099  | 6.49     |
| **variable of grain yield**       |        |             |        |          |
| length of cob, cm                 | 1.2303 | 3.3426      | 2.3370  | 10.91    |
| diameter of cob, cm               | 0.0423 | 0.0542      | 0.0912  | 11.03    |
| number of lines                   | 0.9333 | 2.9037      | 1.5259  | 10.69    |
| number of seeds in row            | 4.9000 | 35.8519     | 23.0852 | 17.47    |
| grain yield (wc. 15%), t/ha        | 0.1936 | 2.8938      | 0.9689  | 11.87    |
The average of all variable included analysis Source of Variation could be founded in table 2, 3 and 4. In table 2 shown of vegetative variable like percentage of growth, plant height, ear height and flowering time (tasseling and silking). The percentage of growth be founded around 75%. Plant and ear height of testcross candidate 197-220 cm and 127 – 121 cm, check 209 cm and ear height 100 cm. The variable of ASI (anthesis silking interval) were 3.0-5.0 and is not significant with check Bima 13Q. In this ASI variable was highly sincronice of tasseling to silking period was less than three days. As long as test cross this new hybrid QPM hoping could be founded high yield. [10, 11] shown that the distribution asi of special ty maize was exponential regression model, and maximum yield be founded in asi between 0-5 days, ASI > six days flowering was not sincronice and no grain yield of the plant. The result of [12] that ASI be importance to increase the yield of maize included of ecological growth and boron nutrition in the soil. In Table 3 shown that variable of ear/cob on harvested time not significant different on check Bima 13Q were 77%. Water content in harvested time 20-21% included periods of flowering. The ear harvested around four kg per plot, and shelling percentage 77-79% and it is not significant with check Bima 13Q were 78%. The number of lines seeds per ear were 14 lines compare check 12 lines.

**Table 2.** The means data of vegetative and flowering stage, Polman 2018

| Genotypes          | growth percentage (%) | plant height, cm | ear height, cm | tasseling, days | silking, days |
|--------------------|-----------------------|------------------|----------------|-----------------|---------------|
| G1. CML161-2-1-4-2 x tester | 79.0                 | 235.0            | 121.0          | 49.3            | 54.7          |
| G2. CML165-3-1-2-4 x tester | 93.3                 | 223.7            | 109.7          | 49.3            | 53.7          |
| G3. CML170-1 x tester    | 93.0                 | 232.7            | 125.7          | 48.7            | 53.0          |
| G4. CML172-2-1-2 x tester | 96.7                 | 197.0            | 119.3          | 49.7            | 53.7          |
| G5. MSQ(S1)C0-26-1-1 x tester | 82.0               | 228.0            | 127.3          | 50.7            | 55.7          |
| G6. MSQ(S1)C0-27-1-1-# x tester | 92.7               | 236.0            | 120.3          | 50.0            | 52.0          |
| G7. MSQ(S1)C0-34-1 x tester | 70.7                 | 225.7            | 126.3          | 48.0            | 54.3          |
| G8. MSQ(S1)C0-43-1-1-1 x tester | 89.7               | 240.3            | 127.7          | 48.0            | 54.0          |
| G9. MSQ.C0 x tester      | 75.3                 | 230.7            | 127.7          | 49.0            | 53.0          |
| G10. Check (Bima 13Q)   | 88.7                 | 209.3            | 109.0          | 49.3            | 57.0          |
| LSD 5%                | 22.90                | 39.60            | 26.13          | 3.78            | 3.80          |
| LSD 1%                | 31.37                | 54.35            | 36.79          | 5.18            | 5.21          |

The yield potential of test cross QPM be founded 10.66-10.95 t/ha in wc.15%, check Bima 13Q were 7.46 t/ha, this analyzed was found of c.v. : 9.89% (Table 4) Two candidates would be promising of new varieties test cross F1 QPM were treatments (genotypes) no G5 (MSQ(S1)C0-26-1-1 x MR14Q and G8 (MSQ(S1)C0-43-1-1-1 x MR14Q). The experiment of [9] founded grain- yield of population QPM: Q.Com.C0(SK2) were 8.50 – 9.0 t/ha in Donggala Central Sulawesi. The two candidates were founded shelling percentage 77.9% and 79.0% and grain yield were hight 30.0 -31.6% compare than check Bima 13Q. [13] that shelling percentage of the maize in drought condition would be less than 70% and under normal condition be increase 80.0%

**Table 3.** The means data of harvested time, Polman 2018

| Genotypes          | ears weight on harvested, kg/plot | weight of 5 ears, kg | weight of 5 seeds in ears, kg | shelling percentage, % | water content, % |
|--------------------|-----------------------------------|----------------------|------------------------------|------------------------|------------------|
| G1. CML161-2-1-4-2xtester | 4.14                             | 1.14                 | 0.88                         | 77.3                   | 20.03a           |
| G2. CML165-3-1-2-4xtester | 4.02                             | 1.11                 | 0.85                         | 76.5                   | 21.00a           |
| G3. CML170-1xtester     | 4.31a                            | 1.12                 | 0.68                         | 79.1                   | 21.87a           |
| G4. CML172-2-1-2xtester | 3.86                             | 1.02                 | 0.81                         | 79.7                   | 20.73a           |
| G5. MSQ(S1)C0-26-1-1xtester | 4.48a                           | 1.36                 | 1.06                         | 77.9                   | 19.97a           |
| G6. MSQ(S1)C0-27-1-1-#xtester | 4.30a                           | 1.09                 | 0.84                         | 77.3                   | 21.13a           |
4. Conclusion
Two population of test cross hybrid QPM: (MSQ(S1)C0-26-1-1 x MR14Q) and (MSQ(S1)C0-43-1-1-1 x MR14Q) were the best hybrids candidate with potential yield 10.66-10.95 t/ha. The different with check Bma 13Q were yield 30.0 - 31.6%. The two candidates were founded shelling percentage 77.9% and 79.0% and asi less than five days. The two candidate hybrids of QPM could be promising as new variety and continuing to evaluation of variety trial (evt) in central maize of West Sulawesi.

References
1. Bourlaug, N. 1992. Potential role of Quality Protein Maize in Sub Saharan Africa. Department of Soils and Crops Texas A&M. University College Station. The American Association of Cereal Chemists St. Paul. Minnesota. USA: 94-95.
2. Mertz, E.T. 1992. Discovery of high lysine, high tryptophane cereals. Departement of agronomy. Purdue University West Lafayette. Indiana. The American association of cereal chemists St. Paul. Minnesota. USA: 94-95.
3. Prasanna, B.B., S.K. Vasal, B. Kassahum and N.N. Singh. 2001. Quality protein maize. Review Article. Current Science 81(10).
4. Pixley, K., N. Palacios, T. Rocheford, R. Bahu and J. Yan. 2010. Agriculture for Nutrition: Maize biofortification strategies and progress. Proceedings of the Tenth Asian Regional Maize Workshop. October 20-23, 2008. Makassar Indonesia.
5. Hallauer, A.R., and J.B. Miranda Fo. 1988. Quantitative genetics in maize breeding. 2nd edition. Iowa State University Press/Ames. p. 411.
6. Vasal, S.K. 2000. Hight quality protein corn. Specialty corn. CRC. Press. CIMMYT. Lisboa 27. D. F. Mexico. Tokyo. p.81.
7. Sharma, J.R. 2008. Statistical and biometrical techniques in plant breeding. New Age International Publishers. Central Institute of Medicinal & Aromatic Plants. Lucknow-226015. New Delhi. p.265.
8. CYMMIT. 2012. Population Improvement of Maize. The Cource of training for Specialty Corn QPM. Breeding Departement. El Batan Mexico.

9. Yasin, H.G.M. dan M.J. Mejaya. 2016. Rancangan statistik khusus pemuliaan jagung (kasus jagung fungsional QPM, Provit A, dan Pulut). IAARD Press. Badan Litbang Pertanian. Jakarta.

10. Tharmizi, A.S., M.H.G. Yasin, A. Rahman, S. Hanafi and Jumiarti. 2021. The distribution model of ASI under anthocyanin corn. Rangkuman Riset Jagung. Pusat Penelitian Jagung dan Serealia UIM. Seri 01. Makassar.

11. Yasin, H.G.M., Sumarno and Amin Nur. 2015. Perakitan varietas unggul jagung fungsional. IAARD PRES. Pusat Penelitian dan Pengembangan Tanaman Pangan. Badan Penelitian dan Pengembangan Tanaman Pangan. Jakarta. p. 51.

12. Luka, A., V. Kovacenic, I. Kadar, A. Jamnronic, H. Plavsix and D. Simic. 2017. Genotypic effect on boron fertilization concentration and response in maize inbred lines. Faculty of Agriculture of University Research Institute for Soil Science and Agricultural Chemistry (RISSAC), Budapest, Hungaria.

13. Magorokosho, C., K. Pixley and P. Tonggoona. 2003. Selection for drought tolerance in two tropical maize population. Crop Science Department, University of Zimbabwe. African Crop Science Journal, **11**. No. 3.