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GROWTH AND YIELD OF THREE VARIETIES OF MAIZE IN DRY LAND AT WAIHATU VILLAGE, WEST PART CERAM REGENCY

PERTUMBUHAN DAN HASIL TIGA VARIETAS JAGUNG LAHAN KERING DESA WAIHATU, KABUPATEN SERAM BARAT

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INTISARI

Kegiatan dilaksanakan Juli sampai Oktober2009, berupa rancangan acak kelompok, tiga ulangan. Tujuan: mengetahui respon tiga varietas jagung pada lahan kering. Petak kajian 15 m×16 m, jarak 75 cm×40 cm, dua tanaman per lubang, varietas Bima-3 Bantimurung, Srikandi Kuning, Bisi-2. Dosis pupuk: 300 kg NPK Phonska, 300 kg Urea, dan dua t ha^{-1}pupuk kandang ayam. Hasil: varietas Bima-3 Bantimurung dan Srikandi Kuning memberikan pertumbuhan dan hasil terbaik dibanding Bisi-2. Penggunaan NPK Phonska dikombinasikan pupuk kandang ayam memberikan hasil jagung lebih tinggi daripada hasil jagung nasional dan Maluku, masing-masing 3,45 t ha^{-1}dan 2,30 t ha^{-1}. Varietas hibrida Bima-3 Bantimurung memberikan rata-rata hasil pipilan kering tertinggi) dan tidak berbeda nyata dengan komposit Srikandi Kuning, tetapi berbeda nyata dengan hibrida Bisi-2. Bima 3 Bantimurung dan Srikandi Kuning sangat potensial dikembangkan pada lahan kering di Maluku karena selain hasilnya tinggi, Bima 3 Bantimurung merupakan jagung hibrida berbiomas tinggi dan tetap hijau sampai panen sehingga limbahnya dapat dimanfaatkan untuk pakan ternak, sedangkan Srikandi Kuning merupakan jagung komposit kaya protein sehingga dapat digunakan sebagai sumber pangan alternatif.

Kata kunci: pertumbuhan, varietas, jagung

ABSTRACT

Activity was conducted in July until October 2009. Research prepared on randomized block design, three replications. Purpose: to know respons of three maize varieties which cultivated on dry land. Size of plots area is 15 m × 16 m, plant spacing 75 cm × 40 cm, two plants per hole. Varieties assess is Bima-3 Bantimurung, Srikandi Kuning, and Bisi-2. Dosage of fertilizer used is NPK Phonska 300 kg, urea 300 kg, chicken manure two t ha^{-1}. Study shows: varieties Bima-3 Bantimurung, Srikandi Kuning give highest growth and yield than Bisi-2. Phonska NPK fertilizer application combined with manure give average yield of maize is higher than average of national and Moluccas yields, each 3.45 t ha^{-1} and 2.30 t ha^{-1}, respectively. Bima-3 Bantimurung hybrid variety gives average highest yield and not significantly different from composite Srikandi Kuning, but significantly different from hybrid Bisi-2. Bima-3 Bantimurung and Srikandi Kuning potentially developed on dry land in Moluccas because in addition to high yield, Bima 3 Bantimurung a maize hybrid that has a high biomass and stay green until harvest so that waste can be utilized for animal feed, while Srikandi Kuning is a composite maize rich of protein that can be used as an alternative food sources.

Key-words: growth, variety, maize.

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INTRODUCTION

The average productivity of maize obtained in Moluccas is still low at 2.30 t ha^{-1} (Anonim 2008) compared with the potential outcome or result in the level of research that can reach five until 10 t ha-1 with the implementation of technological innovations (Anonim 2008a). The low results achieved because of alleged low quality of seeds used, as well as the applied cultivation technology has not been optimal. In Moluccas, corn is the staple food for most people, especially in West Southeast Maluku regency (Alfons*et al* 2004; Susanto & Sirappa 2005), and ranks second largest cultivated.

Balitseral (2006) reported that some of the problems in the cultivation of maize on dry land which led to low productivity, which is due to factors other than abiotic and biotic, as well as traditional cultivation techniques still, using a variety of low quality, low plant population, and the use of fertilizer is not optimal. Agency of Agricultural Research and Development (AARD) has released quite a lot of composite maize varieties and hybrids, but vaietas is not widely known and used by farmers. The use of new varieties, both composite and hybrid high-yielding, old early maturing, resistant to pests and major diseases, tolerant to marginal environments, and quality results in line with consumer tastes is the desired target (Puslitbangtan 2006).

AARD has resulted in maize cultivation technology in an effort to increase productivity, which is based on integrated crop and resource management (ICM). ICM is a model or approach in promoting crop management, land, water and plant pests in an integrated and specific locations. Thus the technology applied to the ICM approach is synergistic and specific locations with the involvement of farmers in a participatory manner (Hasanuddin 2002).

Variety is one component of corn PTT technology is quite instrumental in increasing crop yields, especially when combined with other technology components, such as fertilization. The use of fertilizers in a balanced way taking into account the ability of soil to provide nutrients and nutrient needs of the plant is a concept that site-specific nutrient management. Hara N, P, and K is a nutrient that is needed to grow corn and produce, where for every ton of one produced, corn requires 27.4 kg N, 4.8 kg P, and 18.4 kg K (Cooke 1985). According Wirajaswadi*et al* (1996), agroecosystem diversity between regions requires the application of technology appropriate to local conditions, including the use of varieties according to their environment (Baehaki 1982).

METHODE

The study was conducted on dry land owned by farmers in the Waihatu village, Kairatu district, WestPart Ceram regency in July 2009. Before starting the activities conducted Participatory Rural Appraisal (PRA) to determine the technology that made the cultivation of corn farmers and corn on the problems of dryland farming.

Experimental design used was randomized block design with three replications. Broad swath of the study is 15 m × 16 m for each variety. Varieties studied is the Bima-3 Bantimurung, Srikandi Kuning, and Bisi-2. Plant spacing 75 cm ×

40 cm (two plants per hole). Seed maize included in the planting hole is then covered with soil. Chicken manure at a dosage of two t ha^{-1}are distributed evenly in the plot at the last cultivation. Fertilization is done with a drill in addition to plant distance of about five until seven cm from the stems of plants. Dosage of fertilizer used is NPK Phonska 300 kg, urea 300 kg ha^{-1} in accordance with the recommendations of fertilizer manufacturers. Fertilizer NPK Phonska given twice, each 150 kg at the age of five until 10 days after planting (dap) and the age of 30 dap, whereas urea is given three times which is 75 kg at the age of five until 10 dap and 30 dap and 150 kg in the age of 45 dap.

Parameters observed are the components of growth and yield of plants, including: plant height at harvest, length corn cob husk, circle corn cob without husk, the weight of cornhusk and without cornhusk, the number of seed rows per husk, weight of 1000 grain, yield of shell dry per cob, and yield per plot and per hectare. Agronomic data were tabulated and statistically analyzed using the program system SAS version 6.12, while the differences between treatments by Duncan's test five percent.

The purpose of this study was to determine growth and yield of three varieties of corn on dry land in the Waihatu village, Kairatu district, West Part Ceram regency.

RESULTS AND DISCUSSION

Types and Soil Nutrient Status. The soil types at the study sites classified as alluvial. The results of soil analysis using Dry Soil Test Kit (DSTK) showed that the nutrient status of the phosphate (P) is low, and potassium (K) is high, and C-organic is low, and slightly acidic soil pH. Assessment of soil nutrient status with DSTK only qualitatively. Soil fertility levels are relatively low. Improvement of soil fertility can be done through balanced fertilization. According Setyorini *et a*l (2007), the dose of fertilizer used is 350 kg urea, SP-36 200 kg, KCl 50 kg and 2,000 kg of manure ha^{-1}. However, due to the availability of a single fertilizer is not available, then in this study used fertilizer NPK Phonska according to manufacturer's recommendation.

Rainfall during the study is low, especially from August to October is less than 100 mm per month with rainy day rainy day eight until 10 (Table 1). This situation will affect the growth and yield of maize, especially in the critical phase in the event of drought. Dahlan (2001) reported that in order to be able to grow well, the corn crop requires an average rainfall of 25 mm per week.

According Banzinger*et al* (2000), if the corn crop suffered drought stress on the phase of flowering or seed filling, then the result is only about 30 until 60 percent of the normal condition, whereas if drought stress occurs at flowering to harvest phase, the results are 15 until 30 percent of crop did not experience drought stress.

Table 1. Rainfall and rainy days during the assessment doing

Description	Month (mm)											
	1	2	3	4	5	6	7	8	9	10	11	12
RF	236,9	132,7	135,7	213,6	98,3	208,1	190,7	90,8	17,6	48,4	118,0	93,0
RD	20	15	14	18	17	13	26	10	8	7	9	6

Sources: Climatology Station Kairatu.

Plant Growth and Yield. Components of plant growth as measured in this study were plant height at harvest, while component yield include lengh of cob cornhusk, circle of cob without husk, weight of cob corn husk, weight of cob without husk, number rows per cob, weight of 1000 grains, weight of grain per cob, weight of grain per plot, weight of grain per hectare.

In general, Srikandi Kuning varieties give better growth than Bisi-2 and Bima-3 Bantimurung, although based on the description of varieties Bisi-2 has the highest plant height (232 cm), followed Bima-3 Bantimurung (200 cm) and Srikandi Kuning (185 cm). This situation suggests that the Srikandi Kuning varieties are more tolerant environmental stress (drought) compared to the other varieties, such as in Table 2.

According Balitsereal (2006), there are two major problems in the cultivation of maize, namely: (1) abiotic factors, including lack of nutrient availability in soil, water stress, especially drought, and lack of soil organic matter, and (2) cultivation techniques, including use of low yield potential of varieties, low plant population, and low fertilizer dosage.

From the results of measurements of several parameters of the components of crop varieties is known that the Bima-3 Bantimurung generally has a component of the average yield is higher than Bisi-2 and Srikandi Kuning varieties (Table 2). The average yield of three varieties of maize on NPK Phonska fertilizer and chicken manure at 7.47 t ha^{-1}. The highest yield obtained in the Bima-3 Bantimurung (7.72 t ha^{-1}) and did not different significantly with the Srikandi Kuning variety (7.55 t ha^{-1}), but significantly different with Bisi-2 (7.13 t ha^{-1}), as shown in Table 2. Average of maize yield obtained in this study is

Table 2. Average growth and yield components of three varieties of maize[1)]

Component of Growth and Yield	Varieties		
	Bima-3 Bantimurung	Srikandi Kuning	Bisi-2
Plant height at harvest (cm)	157,27 c	202,53 a	164,13 bc
Lengh of cob cornhusk (cm)	31,53 a	28,60 a	18,13 b
Circle of cob without husk (cm)	12,13 ab	13,97 a	11,50 b
Weight of cob cornhusk (g)	288,33 a	284,00 a	253,00 b
Weight of cob without husk (g)	168,33 ab	184,00 a	159,33 b
Number rows per cob	13,07 ab	15,07 a	11,33 b
Weightof 1000 grains (g)	291,77 a	289,73 a	279,90 b
Weight of grain per cob (g)	157,37 a	153,85 a	145,30 b
Weight of grain per plot (kg) [2)]	7,05 a	6,89 a	6,51 b
Weight of grain per hectare (ton) [3)]	7,72 a	7,55 a	7,13 b

Remarks :The numbes in the same row followed by the same letter are not significantly different in the Duncan's test 5%

[1)] :Average of 5 corn cobs selected proportionally (largest-smallest in the sample plots) and from 3 replications, [2)] :Tile plot 2,5 m 2,5 m

[3)] :Convertion of the tile plot (k.a. 20%)

much higher than the average of the maize yield in the Moluccas (2.30 t ha^{-1}) (Anonim 2008) or the national maize yield (3.45 t ha^{-1}) (Mappaganggang *et al* 2008). This is presumably because in addition to the use of high yielding varieties with high productivity, as well as the use of inorganic fertilizer combined with chicken manure.

The use of animal manure (chicken manure) in this treatment has a very important role on the growth and crop yields, especially its role in improving the soil's water-holding capacity. It is seen from the corn that is high enough even during activity, the plants in the environmental stress conditions (drought), which only rainfall ranges from 17.6 mm until 190.7 mm per month (Table 1), and only the help of some watering times by using a pump machine.

The use of high yielding varieties with ICM technology implementation can improve outcomes and efficiency of corn production inputs (Suryana *et al* 2008). This is evident from the results of research on dryland showed that application of the ICM modeling on Lamuru varieties can have yield 6 to 6.5 t ha^{-1}, on acid dry land using Sukmaraga variety have yield from 5.5 to 6 t ha^{-1}, and on rainfed rice with Lamuru and Srikandi Kuning varieties is able to provide the yield about 6-7 t ha^{-1} (Anonim 2006).

Sirappa*et al*. (2002) suggested that nitrogen fertilization dosages of 120 kg N ha^{-1} on dry land with a total N content is very low to moderate and Inceptisols soil type, capable of delivering the yield of maize six until seven t ha^{-1}. Furthermore Sirappa & Tandisau (2004) and Sirappa*et al*. (2003) reported that the highest maize on three soil types (Entisols, Inceptisols and Vertisols) respectively obtained at the dose of fertilization with 120 kg N, 80 kg P_2O_5 and 80 kg K_2O ha^{-1}.

Balanced fertilization is a site-specific nutrient management, depending on the local environment, particularly land. By Dobermann *et al*. (2003), the concept of site-specific nutrient management to consider the ability of soil to provide natural nutrients and recovery of plant nutrients that were previously used. A similar concept is used for fertilizing the new recommendations on maize in Nebraska (United States), with particular emphasis on understanding the potential outcomes and results as a basis for gap repair site-specific nutrient management recommendations. Site-specific nutrient management seeks to provide nutrients for plants properly, both the number, type, and time of administration, taking into account the needs of plants and the capacity of land to provide nutrients for plants.

Olson & Sander (1988) reported that some of the factors that affect nutrient availability in soil to be absorbed by plants, among others, is the total supply of nutrients, soil moisture and aeration, soil temperature, and physical and chemical properties of soil. Overall these factors are common to each nutrient. Soil moisture and aeration are the factors that influence the production of maize corn so that the results obtained are still below the potential outcome (10 t ha^{-1}), despite being much higher than the average national maize (3.45 t ha^{-1}) (Mappaganggang *et al*. 2008) and yield of corn in the Moluccas (2.30 t ha^{-1}) (Anonim 2008a).

The use of inorganic fertilizers continuously without additional organic fertilizer can deplete soil organic matter and leading to degradation of biological soil fertility. Therefore, the use of organic matter or manure, especially on dry land should receive greater attention, given the amount of land that has been degraded organic material, in addition to expensive inorganic fertilizers. But according to Mayadewi (2007), the use of manure need to consider the right type, because manure can lead to the development of weeds in cultivated land. Further explained that the presence of weeds allowed to grow in a crop can reduce the 20 percent to 80 percent.

Largest decrease in the yield can occur when plants experience water shortages in the flowering phase, the male flowers and female flowers appear, and at the time of pollination. According Banzinger *et al*. (2000), maize plants experiencing drought stress on the phase of flowering or seed filling, the results are about 30 until 60 percent of the normal condition, whereas if drought stress occurs in the phase flowering until harvest, the result is 15 until 30 percent of the plants that do not have drought stress.

From the three varieties was assessment, varieties of Bima-3 Bantimurung and Srikandi Kuning more superior compared with Bisi-2 despite the drought conditions, indicated by growth and yield which highest and significantly different with Bisi-2 or average yield of maize in the Moluccas. Bima-3 Bantimurung enough potential to be integrated with livestock because these varieties are still green at harvest and have a high biomass. Srikandi Kuning is one of the composite variety from CYMMIT Mexico with high protein content, i.e. 10.38 percent protein, 0.477 percent lysine, and 0.093 percent tryptophan (Adnan *et al*. 2010; Azrai 2010; Rahmi *et al*. 2009) so it is suitable to be developed for alternative staple food needs.

CONCLUSIONS AND RECOMMENDATIONS

Growth and yield of the three of maize varieties which assessment have average yield which higher than the national and Moluccas yield average. Bima-3 Bantimurung have average highest yield (7.72 t ha^{-1}) and not significantly different with Srikandi Kuning (7.55 t ha^{-1}), but significantly different with Bisi-2 (7.13 t ha^{-1}). Bima-3 Bantimurung and Srikandi Kuning are the two varieties with the potential to be developed on dry land in Moluccas because beside have high yield, Bima-3 Bantimurung is hybrid variety that have a high biomass and stay green until harvest so it can used as livestock feed, while Srikandi Kuning is the maize composite which protein-rich that can be used as an alternative food sources.

REFERENCES

Adnan, A.M., C. Rapar & Zubachtirodin. 2010. *Deskripsi Varietas Unggul Jagung.* Edisi Keenam. Kementerian Pertanian. Pusat Penelitian dan Pengembangan Petanian. Balai Penelitian Tanaman Serealia.

Alfons, J. B., M. Pesireron, A.J. Rieuwpassa, R. E. Senewe & F. Watkaat. 2004. *Pengkajian Peningkatan Produktivitas Tanaman Pangan Tradisional di Maluku*. Laporan Akhir BPTP Maluku.

Anonim 2006. *Deliniasi Percepatan Pengembangan Teknologi PTT Jagung pada Beberapa Agroekosistem.* Bahan PaduPa dan Puslitbangtan dengan BPTP. Bogor, 13-14 Maret 2006. Balitsereal Maros, 14 hal.

------------------ 2006a. *Inovasi Teknologi Unggulan Tanaman Pangan Berbasis Agroekosistem Mendukung Prima Tani*. Badan Litbang Pertanian, Puslitbangtan.

----------------- 2008. *Maluku Dalam Angka* 2008. Badan Pusat Statistik Provinsi Maluku.

-----------------. 2008a. *Panduan Pelaksanaan Sekolah Lapang Pengelolaan Tanaman Terpadu (SL-PTT) Jagung*. Departemen Pertanian. 38 hal.

Azrai, M. 2004. Penampilan Varietas Jagung Unggul Baru Bermutu Protein Tinggi di Jawa dan Bali. *Buletin Plasma Nutfah*, 10 (2): 49-55.

Baehaki, A. 1982. Stabilitas Hasil Berdasarkan Tingkat Daya Hasil Tanaman dan Pemanfaatannya. Fakultas Pertanian Padjadjaran Bandung.

Banzinger, M., S. Mugo, & G. O. Edmeades. 2000. Breeding for Drought Tolerance in Tropical Maize-Convensional Approach and Challenges to Molecular Approaches. In: Ribaut, J. M. & D. Poland (Eds). *Molecular Approaches for the Genetic Improvement of Cereals for Stable production in Water Limited Environments*, A Strategic Planning Workshop Held at CIMMYT, El Batan, Mexico, 21-25 June 1999, Mexico DF CIMMYT, p.69-72.

Cooke, G.W. 1985. *Fertilizing for Maximum Yield*. Granada Publishing Lmt. London. P. 75-87.

Dahlan, M. 2001. Pemuliaan Tanaman untuk Ketahanan terhadap Kekeringan. Dalam: *Proc. International Conference on Agricultural Development NTT, Timor Timur, and Maluku Tenggara.Kupang*, 11-15 Desember 2001.

Dobermann, A., T. Arkebauer, K. G. Cassman, R. A. Drijber, J. L. Lindquist, J. E. Specht, D. T. Walters, H. Yang, D. Miller, D. L. Binder, G. Teichmeier, R. B. Ferguson & C. S. Wortmann. 2003. Understanding corn yield potential in different environments. p. 67-82. In: L.S. Murphy (Ed.). Fluid focus: the third decade. *Proceedings of the 2003 Fluid Forum*, Vol. 20. Fluid Fertilizer Foundation, Manhattan, KS.

Hasanuddin, A. 2002. *Inovasi Teknologi Peningkatan Produksi Tanaman Pangan di Indonesia.* Bahan Pelatihan bagi Tenaga Pendamping. Kegiatan P3T, Bogor dan Sukamandi, 7-12 Maret 2002.

Mappaganggang, Zubachtirodin & S. Saenong. 2008. Dukungan Teknologi dalam Peningkatan Produksi Jagung. *Pros. Simposium V Tanaman Pangan. Inovasi Teknologi Tanaman Pangan.* Buku I. Kebijakan Penelitian dan Pengembangan Pertanian. Badan Litbang Pertanian.

Mayadewi, Ni N. A. 2007. Pengaruh Jenis Pupuk Kandang dan Jarak Tanam terhadap Pertumbuhan Gulma dan Hasil Jagung Manis. *Agritrop*, 26 (4) 153 – 159.

Olson, R.A. & D.H. Sander. 1988. Corn production. In: *Monograph Agronomy Corn and Corn Improvement.* Wisconsin. p.639-686.

Rahmi, M. Aqil & Syuryawati. 2009. *Teknologi Budidaya Jagung Komposit Srikandi Kuning-1.* Leaflet. Balai Penelitian Tanaman Serealia.

Setyorini, D., Nurjaya, L. R. Widowati, & A. Kusno. 2007. *Petunjuk Penggunaan Perangkat Uji Tanah Kering Versi 1,0.* Balai Penelitian Tanah. BB Litbang SDLP, Badan Litbang Pertanian, Departemen Pertanian. 24 hal.

Sirappa, M.P. & P. Tandisau. 2004. Critical Values and Corn Yield Response to N, P and K Fertilization in the South Sulawesi Dry Land. *Jurnal Agrivigor* 3(3):233-240.

Sirappa, M.P., N. Razak & H. Tabrang. 2002. Pengaruh Pemupukan Nitrogen terhadap Hasil Jagung pada Berbagai Kelas N Tanah Inceptisols Jeneponto. *Jurnal Agrivigor* 2(1):72-77.

Sirappa, M.P., P. Tandisau & A.N. Susanto. 2003. Penentuan Status Hara dan Dosis Rekomendasi Pupuk K untuk Tanaman Jagung pada Lahan Kering. *Jurnal Tanah dan Air* 4(1):11-19.

Suryana, A., Suyamto, Zubachtirodin, Mappaganggang S. Pabbage, S. Saenong, & I N. Widiarta. 2008. *Panduan Pelaksanaan Sekolah Lapang Pengelolaan Tanaman Terpadu (SL-PTT) Jagung*.38 hal. Departemen Pertanian.

Susanto, A.N. & M.P. Sirappa. 2005. Prospek dan Strategi Pengembangan Jagung untuk Mendukung Ketahanan Pangan di Maluku. *Jurnal Litbang Pertanian* 24(2):70-79. Badan Litbang Pertanian, Departemen Pertanian.

Wirajaswadi, L., I. Basuki & A. S. Wahid. 1996. *Kajian Pengembangan Paket Teknologi Budidaya Kacang Tanah di Lahan Sawah Irigasi*. Deptan, Badan Litbang Pertanian, IPPTP Mataram.