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Yield performance of four soybean varieties in rainfed lowland areas in Maros Regency, South Sulawesi

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Abstract

The need for soybeans continues to increase along with the increase in population so that the increase in domestic soybean production needs special attention. One of the efforts is the development of soybean varieties with high yield potential. The purpose of this study was to determine growth and yield performance of four soybean varieties in rainfed lowland areas in Maros Regency. The study was carried out in Toddo Malie Village, Tompobulu District, Maros Regency from January to August 2020. The study used a Randomized Block Design (RAK) consisting of four treatments of soybean varieties (Biosoy 1, Biosoy 2, Detap 1, Dena 1) and five replications on farmer cooperator. The results of the study indicated that growth, yield components and yields were significantly different in the four adapted varieties of soybeans. The highest soybean yields were obtained from Biosoy 2 (1,191 kg / ha), followed by Biosoy 1 (1,158 t / ha), Dena 1 (912 kg / ha) and Detap 1 (778 kg / ha) varieties.

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Introduction

The average of national soybean demand is around 2,400,000 t per year. Meanwhile, domestic production is only to reach 800,000 t (33.33%) of the national need (Directorate General of Food Crops, 2017). To fulfill these food needs, additional imports are needed. According to Harefa (2013) that Indonesia's dependence on imports is due to domestic soybean production does not suffice national needs, while soybean demand increases every year. Therefore, soybean development in several central provinces needs to be improved.

Soybean planted area and harvested area in South Sulawesi from 2006 to 2010 fluctuated with an average of 22,307 ha and 17,009 ha, respectively (Dinas Pertanian Tanaman Pangan dan Hortikutlura Provinsi Sulawesi Selatan, 2013). Meanwhile, soybean production and productivity in the period of 2014 to 2018 in South Sulawesi were 47,179 t and 1,512 t/ha, respectively (Kementerian Pertanian, 2018). To increase the production and productivity of soybeans, it is necessary to support new high-quality seed varieties. One of the new high yielding varieties is Biosoy.

Adaptive superior varieties and the use of quality seeds are important components to meet the demand for soybeans (Sumarno and Adie, 2010; Adisarwanto *et al.*, 2013). The use of certified superior varieties seeds is believed to be able to make a real contribution to increasing crop productivity (Nugrahaeni *et al.*, 2008, Directorate General of Food Crops, 2015). In 2008, the use of certified soybean seeds at the farm level was only 2% (Suastika and Kariada, 2012). Hanafi *et al.* (2014) reported that one of the causes of the decline in soybean production was due to the unbalanced availability and need for superior soybean seeds in the field. The need for quality seeds in each growing season often cannot be fulfilled due to limited availability in the field, so farmers use consumption soybeans as seeds. Furthermore, Mejaya (2011) reported that until now the use of superior soybean varieties has only reached 20% and the use of certified seeds is only 10%. This is driven by the shelf life of soybeans which are not durable, so it is necessary to have a good seed system so that seeds are available when needed at affordable prices.

The soybean varieties recently released by Balai Besar Penelitian dan Pengembangan Bioteknologi dan Sumberdaya Pertanian are Biosoy 1 with a potential yield of 3.3 t/ha and Biosoy 2 3.5 t/ha. Both varieties have wide yield stability in various test locations. The Biosoy 1 and Biosoy 2 lines had relatively the same age (83-84 days), or 7-8 days deeper than the Grobogan variety and 3-4 days earlier than Anjasmoro. The number of pods of these two varieties was more than that of the Grobogan variety but less than the number of pods of Anjasmoro. Seed size can be seen from the weight of 100 seeds of Biosoy 1 and Biosoy 2, respectively 21.74 and 22.35 g/100 seeds, much larger than Anjasmoro's 16.14 g/100 seeds and also larger than Grobogan's 20.72 g/ 100 seeds. The Biosoy 1 and Biosoy 2 varieties have large and sturdy stems characterized by wide stem diameters. Morphologically, Biosoy 1 has a different flower color and hypocotyl color. Biosoy 1 flower color and hypocotyl color is green, while Biosoy 2 flower color and hypocotyl color is purple (Balai Besar Penelitian dan Pengembangan Bioteknologi dan Sumberdaya Pertanian, 2019). This indicates the importance of new high yielding varieties to be introduced and adapted in soybean production centers. The purpose of this study was to determine the growth and yield performance of four soybean varieties in rainfed rice fields in Maros Regency.

Materials and methods

The study was carried out in Toddo Malie Village, Tompobulu District, Maros Regency from January to August 2020. The study used a Randomized Block Design (RAK) consisting of four soybean varieties as treatments and five replications on cooperator farmers

The study area was prepared by tillage using a four-wheel tractor after the rice harvest season (MT I), then drainage was made in the area.

The area of planting plots for each variety is adjusted to the area of the cooperator farmers' fields. Two soybean seeds were planted per planting hole, in a single way at spacing of 40 cm x 20 cm.

All organic fertilizers (fermented manure) were given at the same time as the first weeding. Meanwhile, half the dose of urea and ponska fertilizer was given when the plants were 7-10 days old and the rest was given when the plants were 30-35 days after planting. Plant maintenance, weeding (weed control) and pest and disease control are carried out optimally according to the development of plant-disturbing organisms. Harvesting is done after the plant is physiologically mature (90% of leaves and pods have browned or browned black).

Parameters observed included plant height, number of branches, number of leaves, number of pods, dry weight of stover and seed yield. Data were analyzed by ANOVA and continued with Duncan's multiple distance test (DMRT) at 5% level. Farming analysis was carried out to determine the feasibility of each planted variety.

Results and discussion

The soybean growth

Soybean growth components which include plant height, number of branches and number of leaves are influenced by adapted soybean varieties. Plant height and number of leaves were significantly different by soybean varieties, while the number of branches was not significantly different (Table 1).

Plant height plays an important role in supporting soybean yields. The Detap 1 variety had the highest plant height and was significantly different from the other three varieties, followed by the Dena 1 variety. The Biosoy 1 variety had the lowest plant height. Soybean plants with a posture that is not too tall and a sturdy and strong stem will increase the resistance of the plant to laying down thereby reducing the risk of crop failure and increasing production (Arwin et. al, 2010 dalam Arwin, 2016). Meanwhile, the four varieties had relatively the same number of branches and they were not significantly different. Furthermore, the highest number of leaves was seen in the Dena 1 variety and was significantly different from the number of leaves of other varieties. The number of leaves of the Detap 1 variety was more than the number of leaves of the Biosoy 1 and Biosoy 2 varieties. Purwantoto *et al.* (2014) reported that the number of branches and plant height were affected by the intensity of light received by the plant. Susanto and Sundari (2010) and Zhang *et al.* (2011) stated that it is closely related to plant photosynthesis.

The yield component and yield

The yield and yield components of soybeans are influenced by the adapted soybean varieties. The number of pods, the number of filled pods and the number of empty pods were significantly different in the four adapted varieties (Table 2).

The number of pods and the number of filled pods per plant was higher in Dena 1 and significantly different from the number of pods in the Biosoy 1 and Biosoy 2 varieties, but not significantly different from the number of pods in the Detap 1 variety. Meanwhile, the number of empty pods in the Detap 1 and Dena varieties. 1 was also higher and significantly different from the number of empty pods in the Biosoy 1 and Biosoy 2 varieties. There was a close relationship between the yield component and soybean yield where the seed yield was determined by the yield component (Bizeti *et al.*, 2004; Wirnas *et al.*, 2006). The main characters that have a large direct influence on seed yield are the number of branches, the number of filled pods, the number of empty pods (Malik *et al.*, 2006; Hapsari and Adie, 2010; Hakim, 2012).

However, the yield components are not always directly proportional to the yield of soybeans. Nugrahaeni *et al.* (2011) reported that high seed yields were obtained in slightly branched lines, large number of fertile nodes, deep ripening age and large seed size.

Table 1. Performance of the growth components of four soybean varieties at the age of 50 DAP, Maros MT II 2020

Varieties	Plant height (cm)	Number of branches per plant	Number of leaves per plant
Biosoy 1	36,60 a	4,30 a	22,80 a
Biosoy 2	37,54 a	4,68 a	22,40 a
Detap 1	60,12 c	4,54 a	25,60 a
Dena 1	45,00 b	4,60 a	29,40 b

The numbers in the same column followed by the same letter are not significantly different according to the DMRT test at 5% level

Table 2. Performance of the yield components of four soybean varieties Maros MT II 2020

Varieties	Number of pods per plant	Number of filling pods per plant	Number of empty pods per plant
Biosoy 1	33,20 a	33,20 a	0,40 a
Biosoy 2	40,80 b	40,80 b	0,20 a
Detap 1	48,20 c	46,80 c	3,00 b
Dena 1	49,20 c	46,40 c	2,40 b

The numbers in the same column followed by the same letter are not significantly different according to the DMRT test at 5% level

Table 3. Performance of yield components and yield of four soybean varieties, Maros MT II 2020

Varieties	Weight of dry stover (g/10 plant)	Weight of 1000 seeds (g)	Yield (kg/ha)
Biosoy 1	821,00 c	260,40 b	1.158 c
Biosoy 2	847,40 c	274,00 c	1.191 c
Detap 1	711,60 a	183,60 a	778,3 a
Dena 1	756,00 b	181,60 a	912,0 b

The numbers in the same column followed by the same letter are not significantly different according to the DMRT test at 5% level

In the Table 3 it can be seen that the weight of the stover taken at the time of harvest was highest in the Biosoy 2 variety and significantly different from the weight of the Detap 1 and Dena 1 varieties, but not significantly different from the weight of the Biosoy 1 variety. Meanwhile, the weight of 1000 seeds was also higher. on the Biosoy 2 variety, then Biosoy 1 and significantly different with a weight of 1000 seeds of the Detap 1 and Dena 1 varieties. According to Adie and Krisnawati (2007), soybean seed size is classified as large if it weighs >14 g/100 seeds, medium size if it weighs 10 -14 g/100 seeds, and small when weighing <10 g/100 seeds. This shows that all varieties have large seeds, but Biosoy 1 and Biosoy 2 varieties have larger seed sizes (Fig. 1). Biosoy is a large seed soybean with a yield potential of up to 3.55 t per hectare. Biosoy soybean is a new high yielding variety resulting from a cross between the Bio-KC accession with large seeds and the Bio-KJ accession with medium seeds (Balai Besar Penelitian dan Pengembangan Sumberdaya Genetik Pertanian, 2019).

Fig. 1. Seed size of four soybean varieties

The seed yield achieved in this study was not optimal (Table 3), still low compared to the yield potential of each variety due to flooding at the beginning of the plant growth. In Table 5, the highest seed yields were obtained from the Biosoy 2 variety, then Biosoy 1, although the yields of the two were not significantly different. However, it was significantly different from the yields of the Detap1 and Dena 1 varieties. This is in accordance with the description of the Biosoy 2 and Biosoy 1 varieties which have high yield potential. The advantages of the Biosoy variety are the yield potential of 3.30 t/ha (Biosoy 1) and 3.55 t/ha (Biosoy 2), large seeds (21.74 and 22.35 g/100 seeds) and large stem sizes and sturdy (Balai Besar Penelitian dan Pengembangan Sumberdaya Genetik Pertanian, 2019)

Conclusion

From this study, it can be concluded that the growth, yield components and yields of soybeans were significantly different in the four soybean varieties adapted to rainfed land in the second planting season (after rice). The highest soybean yield was obtained from the Biosoy 2 variety (1,191 kg/ha), followed by the Biosoy 1 (1,158 t/ha), Dena 1 (912 kg/ha) and Detap 1 (778 kg/ha).

References

Adie MM, Dan Krisnawati A. 2007. Biologi tanaman kedelai. Hlm 45-73. Dalam Sumarno dkk. (Eds.). Kedelai, teknik produksi dan pengembangan. Pusat Penelitian dan Pengembangan Tanaman Pangan, Bogor.

Adisarwanto T, Subandi Dan Sudaryono. 2013. Teknologi produksi kedelai. Dalam Sumarno, Suyamto, A. Widjono, Hermanto (eds.). Kedelai, Teknik Produksi dan Pengembangan. Puslitbangtan.

Arwin. 2016. Pengaruh radiasi sinar gamma terhadap keragaman populasi M3 galur- galur mutan kedelai umur genjah. Hlm 26-31. Dalam: A.A.Rahmianna, Sholihin, N.Nugrahaeni, A.Taufik, Suharsono, N.Saleh, E.Ginting, F. Rozi, I.K.Tastra, Hermanto, E.Yusnawan dan D.Harnowo (eds.). Peran Inovasi Teknologi Aneka Kacang dan Umbi dalam Mendukung Prgoram Kedaulatan Pangan. Prosiding Seminar Nasional Hasil Penelitian Tanaman Aneka Kacang dan Umbi. Bogor: Pusat Penelitian dan Pengembangan Tanaman Pangan

Balai Besar Penelitian dan Pengembangan Bioteknologi Dan Sumberdaya Genetik Pertanian. 2019. Biosoy 1 dan Biosoy 2, varietas baru kedelai berbiji besar. Badan Litbang Pertanian, Kementerian Pertanian.

Balai Pengkajian Teknologi Pertanian Sulawesi Selatan. 2009. Laporan Tahunan. Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian. Badan Litbang Pertanian.

Balai Pengkajian Teknologi Pertanian Sulawesi Selatan. 2011. Laporan Tahunan. Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian. Badan Litbang Pertanian.

Balai Pengkajian Teknologi Pertanian Sulawesi Selatan. 2012. Laporan Tahunan. Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian. Badan Litbang Pertanian.

Bizeti HS, de Carvalho CGP, Souza J, Destro D. 2004. Path analysis under multicollinearity in Soybean. Brazilian Archives of Biol. and Tech. J. **47** (5), 669-676.

Dinas Pertanian Tanaman Pangan Dan Hortikultura Provinsi Sulawesi Selatan. 2012. Laporan Tahunan. Pemerintah Provinsi Sulawesi Selatan.

Dinas Pertanian Tanaman Pangan Dan Hortikultura Provinsi Sulawesi Selatan. 2013. Paket rekomendasi teknologi tanaman pangan. Pemerintah Provinsi Sulawesi Selatan.

Direktorat Jenderal Tanaman Pangan. 2015. Pedoman teknis pemberdayaan penangkar benih Tahun Anggaran 2015. Kementerian Pertanian, Jakarta.

Hakim L. 2012. Komponen hasil dan karakter morfologi penentu hasil kedelai. Jurnal Penelitian Pertanian Tanaman Pangan **31**(3), 173-179.

Hanafi H, Subagiyo, Nurhidayat TJ, Siswanto S, Widodo B, Setyono, Suparjana, Sarjiman S, Budiarti Dan S. Habsari. 2014. Laporan akhir pengkajian system jalur benih antar lapang dan musim dalam mendukung perbenihan kedelai di Daerah Istimewa Yogyakarta. BPTP Yogyakarta, Badan Litbang Pertanian.

Hapsari RT, Dan MM Adie. 2010. Pendugaan parameter genetic dan hubungan antar komponen hasil kedelai. Jurnal Penelitian Pertanian Tanaman Pangan **29**(1), 18-23.

Harefa OA. 2013. Analisis dampak ketergantungan Indonesia terhadap impor kedelai dengan produksi kedelai lokal di Indonesia (2002-2011). http://harefatika.blogspot.com.2013/05analisis-dampak-ketergantungan.html

Nugrahaeni N, Sundari dan T, Susanto GWA. 2012. Hasil dan komponen hasil galur-galur kedelai berumur genjah di lahan kering masam di Lampung. Hlm 846. Dalam Prosiding Seminar Hasil Penelitian Tanaman Aneka Kacang Dan Umbi. Malang, 15 November 2011. Pusat Penelitian dan Pengembangan Tanaman Pangan

Kementerian Pertanian. 2018. Statistik Pertanian 2018. Kementerian Pertanian, Republik Indonesia.

Malik MFA, Qureshi AS, Ashrafi M, Ghafoor A. 2006. Genetic variability of the main yield related character in Soybean. International Journal of Agriculture and Biology **8**(6), 815-819.

Mejaya MJ. 2011. Peningkatan produksi kedelai melalui penyediaan benih bermutu. Dalam M.M. Adie, Sholihin, A.A. Rahmianna, I.K.Tastra, F.Rozi, Hermanto, A. Sulistyo dan Sumarni (Eds.). Inovasi Teknologi untuk Pengembangan Kedelai Menuju Swasembada. Prosiding Seminar Nasional Hasil Penelitian Tanaman Aneka Kacang dan Umbi.

Nugrahaeni, Purnomo NJ, Anwari M. 2008. Sistem produksi benih sumber. Lingkages Visit for Staff from Provincial Research and development Organisation to The Indosian Lugems and Tuber Crops Research Institute in Malang, East Java.

Purwantoro Dan T. Sundari. 2014. Kesesuaian genotype kedelai untuk tanaman sela di bawah tegakan pohon karet. Jurnal Penelitian Pertanian Tanaman Pangan **33**(1), 44-53.

Suastika IB, Dan IK Kariada. 2012. Kajian system penyediaan benih unggul bermutu kedelai dalam mendukung program strategis peningkatan produksi kedelai di Wilayah Bali. Proseding Seminar Kedaulatan Pangan dan Energi Universitas Trunojoyo Madura.

Sumarno Dan Adie MM. 2010. Strategi pengembangan produksi menuju swasembada kedelai berkelanjutan. IPTEK Tanaman Pangan **5**(1), 49-63.

Susanto GWA, Dan T. Sundari. 2010. Pengujian 15 genotipe kedelai pada kondisi intensitas cahaya 50% Dan penilaian karakter tanaman berdasarkan fenotipnya. J. Biologi Indonesia **6** (3), 459-471.