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Agronomic Characteristic and Nutrient Content from Several Soybean Promising Lines with High Isoflavones

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Abstract

Soybean is a high protein and source of functional food. Ten soybean promising lines were characterized for its agronomic characters and nutrition contents (protein, lipid, and isoflavone) in eight soybean production centers in Indonesia on 2012. Soybean lines of K/IAC100-64-1004-1037, K/IAC100-997-1035, and IAC100/K-60-1092-1141 have total isoflavone 398.50 ppm, 396.69 ppm, and 394.77 ppm, respectively. The seed yield were 2.70 – 2.82 t/ha, protein content from 34.79 – 37.44%, lipid content from 17.34 – 19.18%, seed weight from 11.53 – 15.33 g, and the days to maturity of 83 days. These lines prospective to be released as high yielding and high isoflavone soybean varieties in Indonesia.

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Keywords: *Glycine max*; promising lines; isoflavone; agronomic character; protein; lipid

Introduction

Soybean is the third most important crops after rice and maize. Soybean has potential role as source for functional food due to its high protein and isoflavone content. The economic value of soybean is very important for the Indonesian society because various processed soy-based foods become their daily consumption. The threshold intake of dietary estrogens necessary to achieve a biological effect in humans appears to be 30–50 mg/d, which is readily attainable by the inclusion of modest amounts of soy protein in the average Western diet [1].

There are two approaches for increasing soybean nutrition as raw material of processed food. First by adding substitution ingredients in processed soybean; and the second is by genetic modification to obtain soybean variety with

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high nutrition content. The second approach is cheaper in the long term and safe for human and environment. The final product of genetic approach is soybean variety with high nutrition and also high yield, so it is more easily adopted by farmers. Until now, Ministry of Agriculture Republic of Indonesia has released 78 soybean varieties, with range of protein content from 33.06 – 46.00% and oil content from 7.50 to 25.00%; but the data on isoflavone content is not yet measured.

Soybean seed is potential for source of isoflavone, which can be used for prevention and treatment of several chronic diseases. It was reported that there were six isoflavone forms in soybean: daidzin, genistin, glycitin, daidzein, genistein, and glycitein. The three major groups of isoflavones found in soybeans were genistein, daidzein, and glycitein. The isoflavone content and composition were various between seed parts (cotyledon, hypocotyl and integument) [2], and determined by genotype and environment. It was supposed that the environmental factor that influenced the isoflavone content was at seed filling period [3,4,5,6,7]. Lee [7] asses the stability of soybean isoflavone content in South Korea, and revealed that genotype Geomjeong1 have high isoflavone content and stable across locations. It was also reported that there were no major genetically determined negative associations among the isoflavones, except for that between glycitin and malonylgenistin. On the contrary, a strong negative environmental association was observed between genistein (along with glycitein) and daidzin (along with genistin). Both genetically and environmentally, total isoflavone content was most closely associated with malonylgenistin. Study on genetics of soybean isoflavone have been done by several researchers. Gutierrez-Gonzalez et al. [8] reported that a total of thirty-five main-effect genomic regions and many epistatic interactions controlling genistein, daidzein, glycitein and total isoflavone accumulation in seeds. The distribution of isoflavone content was continuous and unimodal. The heritability estimates on a line mean basis were 79% for daidzein, 22% for genistein, and 88% for glycitein. Total isoflavone contents ranged from 427.92 to 965.89 μg per gram of dry seed and the protein content ranged from 45.17 to 34.95% in BARC-8 and IAC-100, respectively [9].

Krisnawati and Adie [10] identified isoflavone content of 127 Indonesian soybean genotypes, and obtained range of daidzein from 37.51 – 98.34 mg/100 g, glycetein range from 8.52 – 19.91 34 mg/100 g, and genistein from 20.45 – 60.25 mg/100 g. Isoflavone total of 127 soybean genotypes ranged from 78.77 – 175.57 mg/100 g, meanwhile the check varieties of G100H, IAC 100 and Wilis were 117.08; 105.40; and 106.86 mg/100g, respectively. Cultivars IAS 5 and FT-Abyara grown at Vacaria Brazillian, RS (28°30' S latitude) with temperature average of 19°C, had the highest isoflavone concentrations (218.7 and 163.8 mg/100 g, respectively) [5].

The research aimed was to characterize the agronomic performance and nutrient content form high isoflavone soybean lines.

Materials and methods

Characterization of agronomic performance of ten soybean promising lines and two check varieties (Wilis and Anjasmoro) were conducted in eight soybean production centers (Bogor, Sleman, Klaten, Bantul, Mojokerto, Blitar, Pasuruan, Probolinggo, Tabanan and West Lombok) in 2012. The experimental design in each location was randomized block design with twelve traits and each was replicated four times. The plot size was 2.4 m x 4.5 m, plant distance of 40 cm x 10 cm, two plants/hill. Fertilizer of 50 kg Urea, 100 kg SP36 and 75 kg KCl per ha were applied after planting. Weeding and drainage were according field condition. Pest and disease were controlled intensively at eight days after planting.

Agronomic characters were measured on flowering time, days to maturity, plant height, number of branches per plant, number of nodes per plant, number of pods per plant, 100 seed weight, and seed yield. Protein content was