Isoflavones, anthocyanin and fatty acid composition in soybean genotypes at growth stages R6, R7 and R8.

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INTRODUCTION

Special soybean varieties for human consumption with large seed size and black seed coat are consumed as vegetables or “edamame”. For these products, soybean harvest is recommended at R6 growth stage, when seed filling is complete (Czaikoski et al. 2013). Chemical compounds, as oil, protein, fatty acids, isoflavones and anthocyanins, related with nutrition and health are important for soybean foods (Cheng et al. 2011).

OBJECTIVE

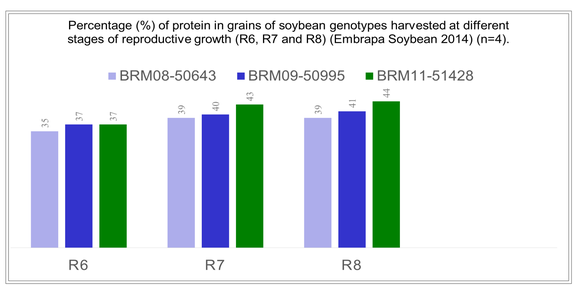
Characterize special breeding lines with yellow and black seed coat, for oil, protein, fatty acids, isoflavones and anthocyanin content in seeds harvested at R6, R7 and R8 reproductive growth stages.

MATERIAL & METHODS

The breeding lines BRM09-50995 (black seed coat), BRM11-51428 (yellow hilum and seed coat) and BRM08-50643 (yellow seed coat and black hilum) were grown in greenhouse in 2014, and seeds were chemically analyzed. Oil and protein were analyzed using NIR (Thermo Scientific, model: Antaris II FT-NIR), fatty acids using Gas Chromatography -GC (Thermo Scientific, model: Trace GC Ultra), isoflavones using UPLC (Waters model: Acquity), and anthocyanins using HPLC (Waters model: Alliance2695). The experimental design was complete randomized blocks with 4 replicates. Statistical program SANEST (Zonta et al. 1982), was used to analyse the data (ANOVA and Tukey´s test) (P ≤0.05).

RESULTS & DISCUSSION

All lines presented higher oil and protein content at R8. In average, from R6 to R8, oil content ranged 22.8% - 24.6% and protein 36.6% - 41.3%. BRM11-51428 presented the lowest oil content (20.4%) at R6, but the highest protein content (44.3%) at R8.



The fatty acids palmitic, stearic and linolenic acids were higher at R6, while linoleic was higher at R7 and oleic at R8 (Table 1). In average of the three stages, BRM08-50643 showed the lowest content of oleic (18%), and the highest content of linoleic (55%) and linolenic (11%) acids. At R8, BRM11-51428 showed the highest content of oleic acid, while BRM09-50995 had the highest content of linoleic and the smallest of linolenic acids (Table 1).

Isoflavones glucosides and aglucones were higher at R8, but the malonyl forms were higher at R7. BRM09-50995 presented the highest content of total isoflavone (471.8 mg/100g) (Table 2). Total aglucones, which are readily available compounds (Tamura 2006), increased about 3 times from R6 to R8. Anthocyanins were present only in BRM09-50995, with a significant larger amount (154.7mg/100g) at R7 than at R6 (27.4 mg/100g) and R8 (41mg/110g).

Table 1 – Percentage (%) of fatty acids (palmitic, stearic, oleic, linoleic and linolenic) in grains of soybean genotypes harvest at different reproductive growth stages (R6, R7 and R8) (Embrapa Soybean 2014) .

Genotypes	R6	R7	R8	Mean
Palmitic (C16:0) (11%)				
BRM08-50643	11.49 Bab	11.58 Ba	12.07 Aa	11.71 a
BRM09-50995	11.22 Ab	11.07 Ab	11.03 Ab	11.11 b
BRM11-51428	11.57 Aa	11.12 Bb	10.99 Bb	11.22 b
Mean	11.43 A	11.26 B	11.36 AB	
Stearic (C18:0) (4%)				
BRM08-50643	4.10 Ba	3.89 Ca	4.30 Aa	4.10 a
BRM09-50995	3.51 Ab	3.36 Bb	3.35 Bb	3.41 c
BRM11-51428	3.24 Ac	3.10 Bc	2.92 Cc	3.09 B
Mean	3.62 A	3.45 C	3.52 B	
Oleic (C18:1) (24%)				
BRM08-50643	18.55 Bc	16.50 Cc	19.11 Ac	18.05 c
BRM09-50995	21.46 Ab	21.21 Bb	21.25 Bb	21.31 b
BRM11-51428	24.39 Aa	23.25 Ba	24.46 Aa	24.03 a
Mean	21.47 B	20.32 C	21.61 A	
Linoleic (C18:2) (54%)				
BRM08-50643	54.89 Ba	56.36 Aa	53.73 Cb	54.99 a
BRM09-50995	53.50 Bb	55.09 Ab	55.26 Aa	54.62 b
BRM11-51428	50.65 Cc	52.73 Ac	52.21 Bc	51.86 c
Mean	53.01 C	54.73 A	53.73 B	
Linolenic (C18:3) (9%)				
BRM08-50643	10.65 Ba	11.25 Aa	10.34 Ca	10.75 a
BRM09-50995	9.93 Ac	8.90 Bc	8.76 Cc	9.19 c
BRM11-51428	10.06 Ab	9.73 Bb	9.42 Cb	9.73 b
Mean	10.21 A	9.96 B	9.51 C	

Means (4 replicates) followed by same small letters in the columns and capital letters in the lines are not different by Tukey’s test (P≤ 0.05%).

Table 2 – Total content (mg/100g) of isoflavones, glucosides, malonyl glucosides and aglucones (%) in grains of soybean genotypes harvest at different reproductive growth stages (R6, R7 and R8) (Embrapa Soybean 2014) .

Genotypes	R6	R7	R8	Mean
Total Glucosides				
BRM08-50643	25.90 Ca	41.64 Ba	104.05 Ab	57.19 b
BRM09-50995	27.14 Ca	45.38 Ba	173.03 Aa	81.85 a
BRM11-51428	14.89 Cb	28.67 Bb	81.32 Ac	41.63 c
Mean	22.64 C	38.56 B	119.46 A	
Total Malonyl Glucosides				
BRM08-50643	224.90 Ca	514.36 Aa	352.84 Bb	364.03 a
BRM09-50995	187.74 Ca	534.39 Aa	413.61 Ba	378.58 a
BRM11-51428	170.67 Ca	456.77 Ab	280.71 Bc	302.72 b
Mean	194.44 C	501.84 A	349.05 B	
Total Aglucones				
BRM08-50643	3.45 Cb	7.29 Bb	14.54 Ab	8.43 b
BRM09-50995	6.29 Ca	10.52 Ba	20.29 Aa	12.37 a
BRM11-51428	1.47 Bc	2.24 Bc	4.50 Ac	2.74 c
Mean	3.74 C	6.68 B	13.11 A	
Total Isoflavones				
BRM08-50643	249.00 Ca	563.29 Aa	503.71 Bb	438.67 b
BRM09-50995	238.49 Ca	524.19 Bb	652.88 Aa	471.85 a
BRM11-51428	187.03 Cb	487.69 Ac	567.10 Bc	347.27 c
Mean	224.84 C	525.05 A	507.90 B	

Means (4 replicates) followed by same small letters in the columns and capital letters in the lines are not different by Tukey’s test (P≤ 0.05%).

CONCLUSIONS

BRM09-50995 with black seed coat, high content of isoflavones and anthocianins, can be released as a good vegetable source to process nutritive and functional soyfoods.

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