AS> Vol.3 No.6, October 2012

OPEN ACCESS

Seed protein, oil, fatty acids, and minerals concentration as affected by foliar K-glyphosate applications in soybean cultivars

PDF (Size:138KB) PP. 848-853 DOI: 10.4236/as.2012.36103

Author(s)

Manju Pande, Mudlagiri B. Goli, Tyneiseca Epps, Nacer Bellaloui

ABSTRACT

Previous studies showed that glyphosate (Gly) may chelate cation nutrients, including potassium (K), which might affect the nutritional status of soybean seed. The objective of this study was to evaluate seed composition (protein, oil, fatty acids, and minerals) as influenced by foliar applications of K + Gly. A greenhouse experiment was conducted at Mississippi Valley State University, using two glyphosate-resistant soybean cultivars DK 4968 and Pioneer 95Y70 grown in a randomized complete block design. The treatments were foliar applications of K alone, Gly alone, K + Gly combined, and nontreated control (C). A single application of potassium (1.75% as K_2SO_4) was applied, and Gly was applied at a rate of 0.75 ae/ha at V5 stage. Leaf samples were harvested one week after treatment (1WAT) and 3WAT. Mature seeds were collected at harvest maturity (R8). The results showed that K, nitrogen (N), and phosphorus (P) concentrations increased in leaves in K alone and K + Gly treatments at 1WAT, but significantly increased at 3WAT in all treatments. The concentration of iron (Fe) and zinc (Zn) showed a decrease in leaf concentration in Gly and K + Gly treatments compared to C. Boron (B) concentration increased in Gly treatment. Seed protein percentage was higher in all treatments in cultivar DK 4968, and the increase was about 4.0% in K treatment, 6.9% in Gly treatment, and 3.5% in K + Gly treatment compared to C. The opposite trend was observed in oil concentration, especially in Gly treatment where the percentage decrease was 11.2% compared to C. Stearic fatty acid was significantly higher in K + Gly treatment compared to K treatment for DK 4968. A higher percentage increase in linolenic acid was observed in DK 4968 in K treatment (an increase of 24.5%) and in K + Gly treatment (an increase of 29.5%) compared to C. In Pioneer 95Y70, the decrease in oil was 2.7% in K treatment and 2.3% in K + Gly treatment compared to C. Stearic acid in Pioneer 95Y70 was significantly higher in Gly treatment, an increase of 8.3%, compared to C. Our research demonstrated that foliar application of K and Gly altered mineral concentration in leaves and shifted seed composition towards protein and stearic concentration. Further research under field conditions is needed before final conclusions are made.

KEYWORDS

Fatty Acids; Glyphosate; Nutrition; Oil; Potassium; Protein; Seed Composition; Soybean

Cite this paper

Pande, M. , Goli, M. , Epps, T. and Bellaloui, N. (2012) Seed protein, oil, fatty acids, and minerals concentration as affected by foliar K-glyphosate applications in soybean cultivars. *Agricultural Sciences*, 3, 848-853. doi: 10.4236/as.2012.36103.

References

[1] M Vyn, T.J., Yin X., Bruulsema, T. W., Jackson, C. C., Rajcan, I. and Brouder, S. M. (2002) Potassium placement: What's new for soybeans and corn in conservation tillage systems? Journal of Agricultural Food Chemistry, 50, 3501-3506.

[2] Chang, E.T., Lee, V.S., Canchola, A.J., Clarke, C.A., Purdie, D.M., Reynolds, P., Anton_ Culver, H., Bernstein, L., Deapen, D., Peel, D., Pinder, R., Ross, R.K., Stram, D.O., West, D.W., Wright, W.,Ziogas, A. and Horn-Ross, P.L. (2007) Diet and Risk of Ovarian Cancer in the California Teachers Study Cohort. American Journal of Epidemiology, 165, 801-813.

[3] Hasler, C.M. (1998) Scientific status summary on functional foods: Their role in disease prevention

- Open Special Issues
- Published Special Issues
- Special Issues Guideline

AS Subscription

Most popular papers in AS

About AS News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

and Health promotion. Food Technology, 52 (2), 57-62.

[4] Messina, M. (1995) Modern applications for ancient bean: soybeans and the prevention and treatment of chronic disease. Journal of Nutrition, 125 (3), 567S-569S.

[5] Messina, M, Gardner, C., Barnes, S. (2002) Gaining insight into the health effects of soy but a long way still to go: Commentary on the fourth International Symposium on the Role of Soy in Preventing and Treating Chronic Disease. Journal of Nutrition, 132 (3), 547S-551S.

[6] Caragay, A. B. (1992) Cancer-preventive foods and ingredients. Food Technology, 4, 65-68.

[7] Fair, D. E., Ogborn, M. R., Weiler, H. A., Bankovic-Calic, N., Nitschmann, E. P., Fitzpatrick-Wong, S. C. and Aukema H. M. (2004) Dietary Soy Protein Attenuates Renal Disease Progression After 1 and 3 Weeks in Han:SPRD-cy Weanling Rats. The American Society for Nutritional Sciences, 134 (6), 1504-1507.

[8] Dev, G.(1995) Potassium-An essential nutrient. Use of Potassium in Punjab Agriculture. Potash and Phosphate Institute of Canada, India Programe, Gurgaon (Haryana). 113.

[9] Myers, S.W., Gratton, C., Wolkowski, R.P., Hogg, D.B. and Wedberg, J.L.(2005) Effect of soil potassium availability on soybean aphid (Hemiptera: Aphididae) population dynamics and soybean yield. Journal of Economic Entomology, 98, 113-120.

[10] Hoeft, R.G., Nafziger, E.D., Johnson, R.R. and Aldrich, R. (2000). Modern Corn and Soybean Production. MCSP Publications, USA, pp. 353.

[11] Tiwari, S.P., Joshi, O.P. and Billore, S.D. (2001) Realisable yield potential of soybean varieties at farm level in India. In: Souvenier “ Harnessing the soy potential of soybean for health and wealth ” India Soy Forum SOPA, India, pp. 108-112.

[12] Tiwari, S.P., Joshi, O.P., Vyas, A.K. and Billore, S.D. (2001) Potassium nutrition in yield and Quality. www.ipipotash.org, pp. 307-320.

[13] Sale, P. W. G. and Campell, L. C. (1986) Yield and composition of soybean seed as a function of potassium supply. Plant and soil, 96, 317-325.

[14] Annadurai, K., Seshadri, P. and Palaniappan, S.(1994) Influence of Potassium levels on yield and oil content in sunflower-soybean sequence. Journal of Potassium Research, 10 (2), 124-129.

[15] Bellaloui, N., Reddy, K.N., Zablotowicz, R.M. and Mengistu, A. (2006) Simulated glyphosate drift influences nitrite assimilation and nitrogen fixation in glyphosate-resistant soybean. Journal of Agricultural and Food Chemistry, 54, 3357-3364.

[16] Anuradha, K. and Sharma, P.S. (1995) Effect of moisture stress and applied potassium on yield and biochemical parameters of soybean in vertisols. Journal of Oilseeds Research, 12, 275-278.

[17] Burton, J.W. (1985) Breeding soybean for improved protein quantity and quality. In: World Soybean Research Conference III: Proceedings (Ed.R. Shibles), Boulder Westview Press, CO, pp. 361-367

[18] Ruiz, J.M. and Romero, L. (2002) Relationship between potassium fertilization and nitrate assimilation in leaves and fruits of cucumber (Cucumis sativus) plants. Annals of Applied Biology, 140, 241-245.

[19] Panthee, D.R., Pantalone, V.R., Sams, C.E., Saxton, A.M., West, D.R. and Rayford, W.E. (2004) Genomic regions governing soybean seed nitrogen accumulation. Journal of the American Oil Chemists' Society, 81, 77-81.

[20] Bott, S., Tesfamariam, T., Candan, H., Cakmak, I., Romheld, V. and Neumann, G. (2008) Glyphosate induced impairment of plant growth and micronutrient status in glyphosate-resistant soybean (Glycine max L.) Plant Soil, 312, 185-194.

[21] Neumann, G., Kohls, S., Landsberg, E., Souza, S.K.O., Yamada,T. and Romheld, V. (2006) Relevance