# CORRELATION AMONG PRINCIPAL CHEMICAL COMPONENTS IN COMMON BEANS GENOTYPES FROM RIO GRANDE DO SUL, BRAZIL

**Gilberto A Peripolli Bevilaqua, Iraja Ferreira Antunes**

(Embrapa Clima Temperado, BR 392, km 78, CxP 403, Pelotas, RS, Brasil.
Email: gilberto.bevilaqua@embrapa.br)

**INTRODUCTION:** The common bean has been object of breeding programs aiming the development of new cultivars adapted to varied production system and shown differentiated nutritional characteristics. Food quality and economic viability has been common objectives in breeding programs in several countries. The bean breeding program of Embrapa are looking for cultivars that have highlighted features of the nutritional point of view due to the recognized fact that inadequate intake of mineral nutrients leads to numerous disorders and metabolic abnormalities (FRANCO, 1999). Minerals are vital nutrients for life and are found naturally in soil; are passed to the plant and its grain, which are consumed by animals and humans. Pinheiro et al (2010) analyzing germplasm from Portugal, observed high degree of variability for P, Fe, Zn, Cu, Mn and Ca. The high mineral variability observed in the seeds can be useful for the selection of cultivars with higher nutrition value and for the improvement of seed nutrition quality traits. The aim of this paper was to verify the correlation between nutritional characters in breeding cultivars and landraces of bean from Rio Grande do Sul state, Brazil.

**MATERIAL AND METHODS:** The experiment was conducted in 2009/2010 in Experimental Station Cascata, of Embrapa Temperate Agriculture. Whole grain of 54 bean genotypes with black and no black coat including commercial cultivars and landraces from Rio Grande do Sul State were analyzed. The fertilization was made with 300 kg $ha^{-1}$ of NPK fertilizer formulation 10-30-10, without the use of topdressing nitrogen. The soil cultivated was a planossolo with low fertility.

Were determined the follow components: potassium (K) analyzed through atomic emission mode, calcium (Ca) and magnesium (Mg) were evaluated by the method of Miyazawa et al. (1992), using atomic absorption spectrophotometry (AAS), as cited by Silva (1999). The determination of phosphorus (P) was made by UV-VIS spectrophotometry, quoted by Silva (1999). For nitrogen (N) and sulfur (S) technique was used in combustion equipment CHN elemental analyzer TruSpec-S. The oligoelements were analyzed by the following methods: copper (Cu) - using the Perkin-Elmer (1982), Miyazawa et al. (1992b), Malavolta et al. (1989); iron (Fe) - by means of the method Ohlweiler (1974) and Malavolta et al. (1989); manganese (Mn) - methodology with Perkin-Elmer (1982), Miyazawa et al. (1992b); and zinc (Zn) - method using Perkin-Elmer (1982) and Malavolta et al. (1989), by atomic absorption spectrophotometry (AAS), as stated by Silva (1999). The crude protein content was determined according to the Kjeldahl method, considering the mean of two readings per sample. The content of the antioxidant astragalina was determined using HPLC techniques according Correia et al. (2006).

**RESULTS AND DISCUSSION:** The correlations between various components in whole grains beans were quite low, as is seen in Table 1. In opposite Silva et al. (2012), that observed positive correlations between most nutrients, indicating the possibility of obtaining lines with higher nutritional value by selection. The potassium content correlated positively with phosphorus and copper, with a correlation coefficient of 0.57 and 0.43, respectively. Nitrogen showed high positive correlation with iron (R = 0.42) and, as expected, was correlated with the total protein

content, although it may be considered reasonable. This fact is related with the different methods used for the determination of N.

Table 1- Correlation coefficients between macro and microelements, protein content and antioxidant astragalina (AST) in whole grains of bean landraces and breeding cultivars from Rio Grande do Sul state. Brazil, 2012.

| | K | Mg | P | N | S | Cu | Fe | Mn | Zn | AST |
|---|---|---|---|---|---|---|---|---|---|---|
| Ca | 0.18 | 0.0009 | 0.23 | -0.35 | -0.1 | 0.16 | 0.09 | 0.21 | 0.09 | 0.14 | -0.22 |
| K | # | -0.04 | 0.57* | 0.25 | -0.29 | 0.43* | 0.25 | 0.17 | 0.14 | 0.32 | -0.23 |
| Mg | | # | 0.009 | 0.16 | 0.31 | 0.08 | 0.21 | 0.32 | 0.27 | 0.04 | -0.33 |
| P | | | # | 0.3 | 0.04 | 0.29 | 0.39 | 0.28 | 0.14 | 0.14 | -0.35 |
| N | | | | # | -0.03 | -0.08 | 0.42* | 0.12 | -0.05 | -0.10 | 0.68* |
| S | | | | | # | -0.22 | -0.16 | 0.03 | -0.37 | -0.29 | 0.17 |
| Cu | | | | | | # | 0.18 | -0.02 | 0.44* | 0.43* | -0.48* |
| Fe | | | | | | | # | -0.21 | 0.64* | -0.15 | -0.44* |
| Mn | | | | | | | | # | -0.02 | -0.02 | -0.003 |
| Zn | | | | | | | | | # | 0.24 | -0.49* |
| AST | | | | | | | | | | # | -0.17 |

*correlation significant at 5% probability

These data show that in breeding, the lines selection for high levels of macronutrients and oligoelements in grain can be realized, thus specific nutrient such iron and calcium, not exhibit negative correlations with other important nutrients. Copper and iron showed high positive correlation with zinc (R = 0.44 and 0.64, respectively). These results are in agreement with Mesquita et al. (2007). Among all nutrients analyzed only copper showed positive correlation (R = 0.43) with the content astragaline, the other elements had no correlation with that component. As the correlation with the nutrient content of protein, only the oligoelements, copper, iron and zinc showed a high negative correlation with protein content in grain, with a correlation coefficient of -0.48, -0.44 and -0.49, respectively. This may demonstrate that increasing levels of oligoelements may negatively affect protein and antioxidants in the grain. These results disagree with Mesquita et al. (2007), in which the strains analyzed showed higher protein contents also stood out in relation to P content, however high protein was not associated with high potassium content. Fe content was positively correlated with Mn and Ca content and Zn was positively correlated with the N, P, Cu and S, fact not observed in this results.

**CONCLUSION:** The oligoelements Cu, Fe and Zn are negatively correlated with protein, but Fe is correlated positively with nitrogen and Cu with astragaline; Ca showed no correlation with elements analyzed.

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