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NUTRITIONAL QUALITY IMPROVEMENT IN COMMON BEANS BY GENETIC REDUCTION OF PHYTIC ACID AND OTHER ANTINUTRITIONAL FACTORS

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When common bean grains are consumed, phytic acid, raffinosaccharides, polyphenols and tannins exert major antinutritional effects such as reduced phosphate, iron and zinc absorption, low protein digestibility, and flatulence. Moreover, if cooking is not properly carried out, lectins and protease inhibitors may exert toxic intestinal effects.

In order to improve the nutritional characteristics of bean grain used for human consumption and potentially for feeding monogastric animals, we developed several innovative bean lines. First, we developed several lectin-free (***lf***) lines producing coloured seeds, then we combined the ***lf*** and the ***wsc*** (white seed coat, correlated with very low amounts of tannins and polyphenols) traits in the same genetic background. Finally, we introduced the low phytic acid (***lpa280-10***) trait in the ***lf*** and ***lf*** + ***wsc*** backgrounds. Since it is well known that *lpa* mutations may cause negative physiological effects in bean seeds, in particular lower seedling emergence and thus lower grain yield, we submitted the new bean lines to a field performance test carried out in two Italian locations, as well as to biochemical analyses and bioassays aimed to evaluate their nutritional and technological characteristics.

Obtained results were as follows :

1. The introgression of the *lpa* mutation caused large phytate reductions (80-90%) without affecting yield or introducing negative agronomical effects.

2. Compared to a suitable control line, bio-availability of bean grains iron (assayed by the in vitro digestion/Caco-2 cells bioassay measuring the amount of accumulated ferritin) was enhanced 2.5 folds in a line with a low content of tannins and polyphenols and exhibited a further 2.5 folds increase in a line with the same background additionally endowed with the low phytate trait. Moreover, unexpectedly, in the new beans we found a remakable increase of protein content.

3. Statistical analyses of the obtained biochemical data revealed a number of highly significant correlations between the 11 investigated parameters, some of which were expected (such as the positive interactions Fe/Zn, tannins/polyphenols), while others (for

example the negative interactions protein/Pi, protein/polyphenols) need further investigation to be interpreted.

Further testing and development of these breeding lines are underway to confirm the *in vitro* observations in an animal model.