

COMMON BEAN (*PHASEOLUS VULGARIS* L) MICRONUTRIENT ANALYSIS PLATFORM



PURPOSE

The platform supports the common bean breeding programs within the Pan Africa Bean Research Alliance (PABRA) by phenotyping bean germplasm for seed iron and zinc content. Superior lines are promoted as high iron beans/ or utilized as parents for enhancing nutritional quality among popular bean market. The platform is also used to validate SeedFe and SeedZn levels in already released varieties in Africa to support programs that aim to promote biofortified bean. The platform is accessible to researchers working on beans in Africa that also includes Universities.

TARGET ELEMENTS

Seed Iron and Zinc content are key priority traits for the bean program. These micronutrients are essential micronutrients for normal human growth and development. They are commonly deficient in diets of the most vulnerable people.

ANALYSIS TECHNIQUE USED

Energy Dispersive X-ray Fluorescence Analysis (EDXRF). It is based on an elemental analysis of the sample through measuring energy given off by excited atoms of an element. The energy and intensity of fluorescence provides information about elemental make-up.

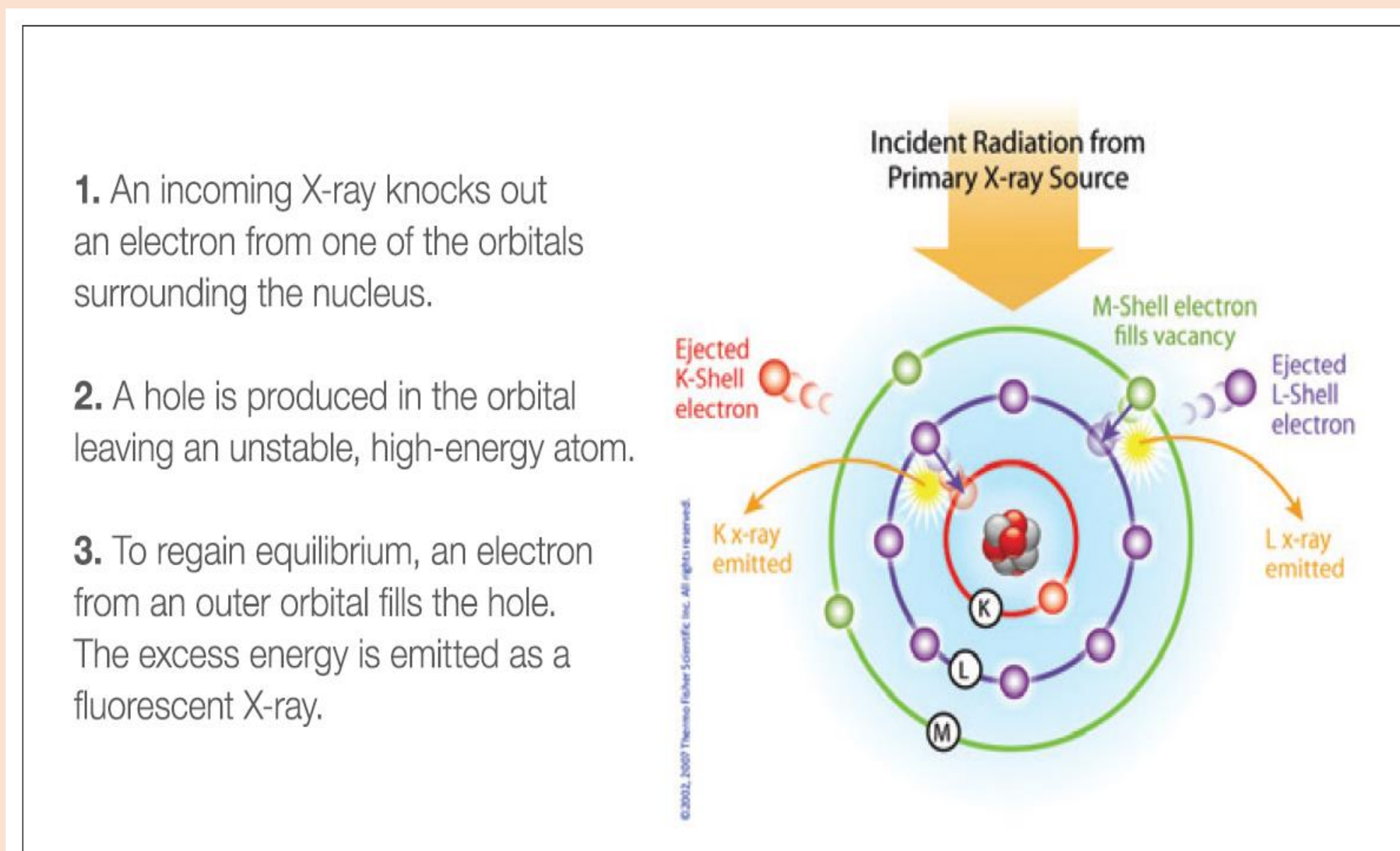
The EDXRF spectrometer irradiates the sample with X-rays and measures the energy (wavelength) and intensity of the generated fluorescent X-rays emitted by the excited atoms to determine the elemental makeup the sample. This principle occurs in 3 major steps below.

GRAIN SAMPLE PREPARATION

- Before the main harvest, approximately 25-30 well-filled pods are randomly picked from each plot.
- Only pods that hung above the ground are sampled from middle rows of plots with multiple rows.
- Pods are sampled from different positions on a plant.
- To prevent contamination with soil, samples are placed in clean envelopes and labelled
- The samples are now ready for SeedFe and SeedZn analysis

ANALYSIS CONDITIONS FOR IRON AND ZINC

Iron (Fe) - Mid Za	Parameter
Voltage	16kV
Livetime	60 seconds
Filter	Pd Thin
Max - Energy	40 keV
Warmup time	2 seconds
Atmosphere	Air
Current	Auto
Zinc (Zn) - Mid Zb	Parameter
Voltage	20kV
Livetime	60 seconds
Filter	Pd Medium
Max - Energy	40 keV
Warmup time	2 seconds
Atmosphere	Air
Current	Auto



INSTRUMENT USED

Thermo Scientific ARL Quant'x EDXRF. The instrument can potentially measure up to 78 elements ranging from heavy elements.

LABORATORY SAMPLE PREPARATION

- Seed are further surface cleaned with a cloth dampened with distilled water (successfully reduces contamination from ~15 ppm Al to 2 ppm Al and Fe by about 5 ppm)
- Sample are oven dried in paper bags at 60 °C for 60 hours to constant weight.
- 10-20 seeds are randomly picked per sample.
- Seeds are ground to flour using a Retsch Mixer Mill MM 400 fitted with ZrO grinding jars and balls or using a coffee grinder.
- Ground samples are stored in newly labelled zip lock bags.
- Grinder Jars are washed with soap & distilled water and blot dry using a paper towel

COMPARATIVE ADVANTAGES OF EDXRF

- Sensitive to low concentrations. Minimum detection limits below 0.1% in the best cases (1ppm).
- Affords a high degree of relative precision. Typically, 2-4%.
- Environment-friendly analysis
- Usually requires minimal sample preparation effort & time

Delivers complete analyses of complex samples quickly, often in under a minute

