

SEED AND *in vivo* CUTTING MUTAGENESIS FOR BROADENING GENETIC VARIABILITY IN *Coffea arabica*.

BY

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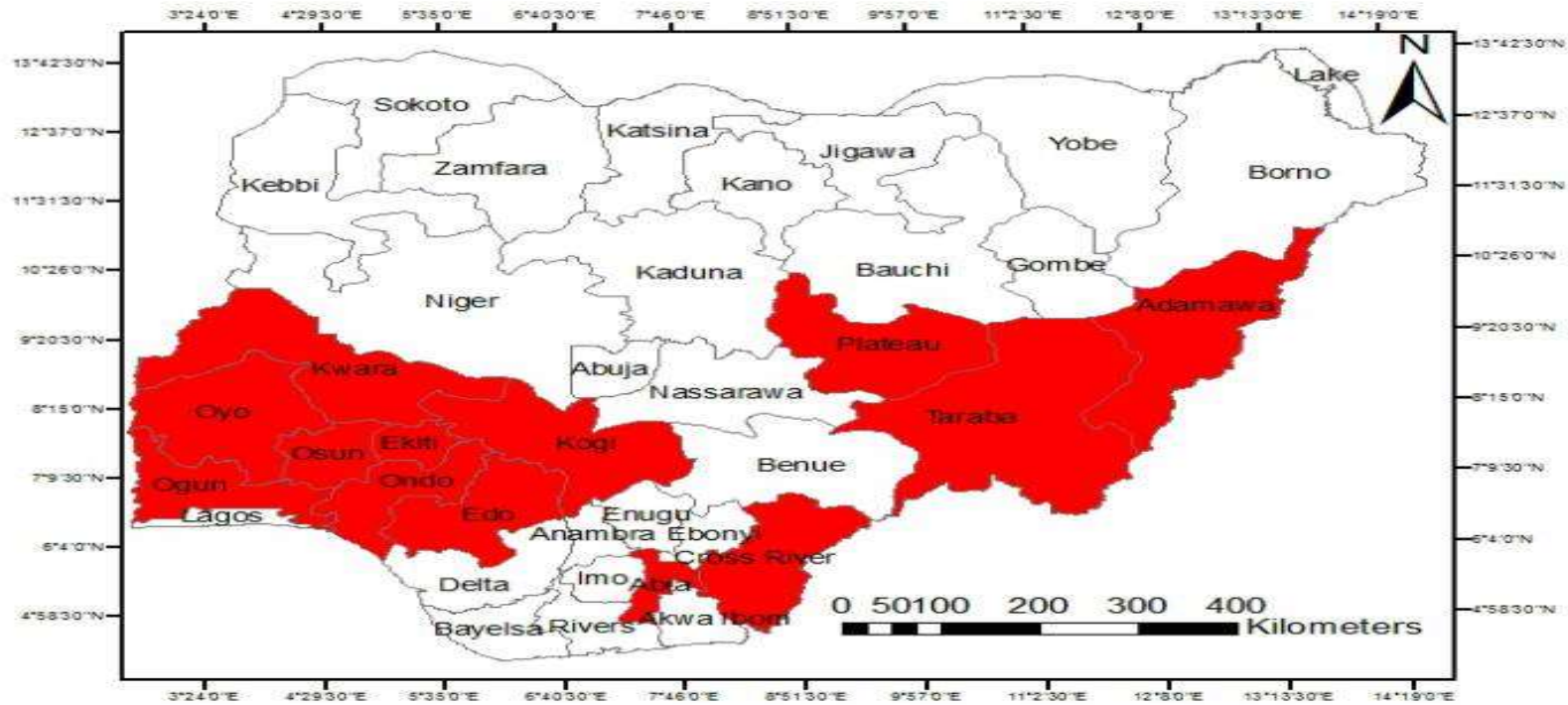


IAEA

Joint FAO/IAEA Division
Nuclear Techniques in Food and Agriculture

Introduction

- Coffee is known to be one of the most important beverages in the world with an estimated value of US\$10 billion.
- It is the most traded agriculture commodities second in value only to oil with a huge contributor of foreign exchange earnings for developing countries (Labouisse et al., 2008)
- It is a widely consumed commodity with a daily consumption of an approximate 2 billion cups (BCA,2017)
- Coffee is one of the fourteen exportable commodities cultivated in Nigeria
- It is a source of revenue to the country with an estimating value of over US\$13.5 million (Dada et al, 2017).





Coffee is at risk?

World Coffee Research

The livelihoods of coffee farmers and the businesses who rely on these farmers to grow great coffee are urgently threatened by:

- **Climate Change**
- **Low Yields**
- **Diseases & Pests**
- **Barriers to Quality**



Hardy-Weinberg equilibrium

States that the genetic variation in a population will remain constant from one generation to the next in the absence of disturbing factors

- With a worldwide decline in plant genetic resources, an increasing demand in plant production, new methods of crop diversity are required to address agricultural challenges
- The methods include the use of plant breeding, genetic engineering and induced mutations
- Arabica coffee improvement is a serious concern for plant breeders as the crop does not have adequate genetic diversity from which breeding of varieties suitable to face the problems and constraints that result from climate change (Schilling, 2015)

- Mutation breeding is the genetic manipulation of genomic component of living organism.
- Mutagenesis is the general methods for mutation induction.
- For Physical Mutagenesis, determination of a relative measure that gives an indication of the effects of irradiation treatments on the irradiated objects (Radio sensitivity) is crucial.
- Prior to starting a mutation breeding programme, radio-sensitivity tests need to be performed to determine the optimal dose treatment for mutation induction

Materials and Methods

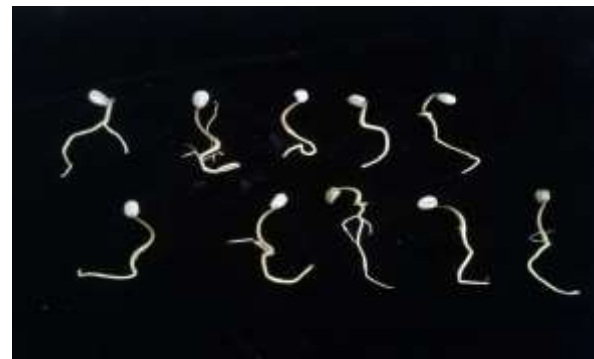
- 600 seeds each of the coffee varieties were collected from a freshly harvested coffee berries
- Bud wood of orthotropic shoot of Coffee were collected from the coffee varieties
- The bud wood were cut to 1800 cuttings each of the variety
- Both the seeds and cuttings were irradiated at Nigeria Nuclear Regulatory Agency (NNRA)
- Cobalt 60 source of Gamma irradiation were used

- The seeds were treated with 50, 100, 150, 200 and 300 Gy with control of 0 Gy
- The cuttings were treated with 5, 10, 15, 20 and 25 Gy with control at 0 Gy.
- The seeds were pre germinated in a top soil mixed with cured saw dust as vermiculate
- The cuttings were treated in rooting hormone (IBA) at 7000 ppm
- The data on percentage germination on seeds commenced 6 weeks after sowing

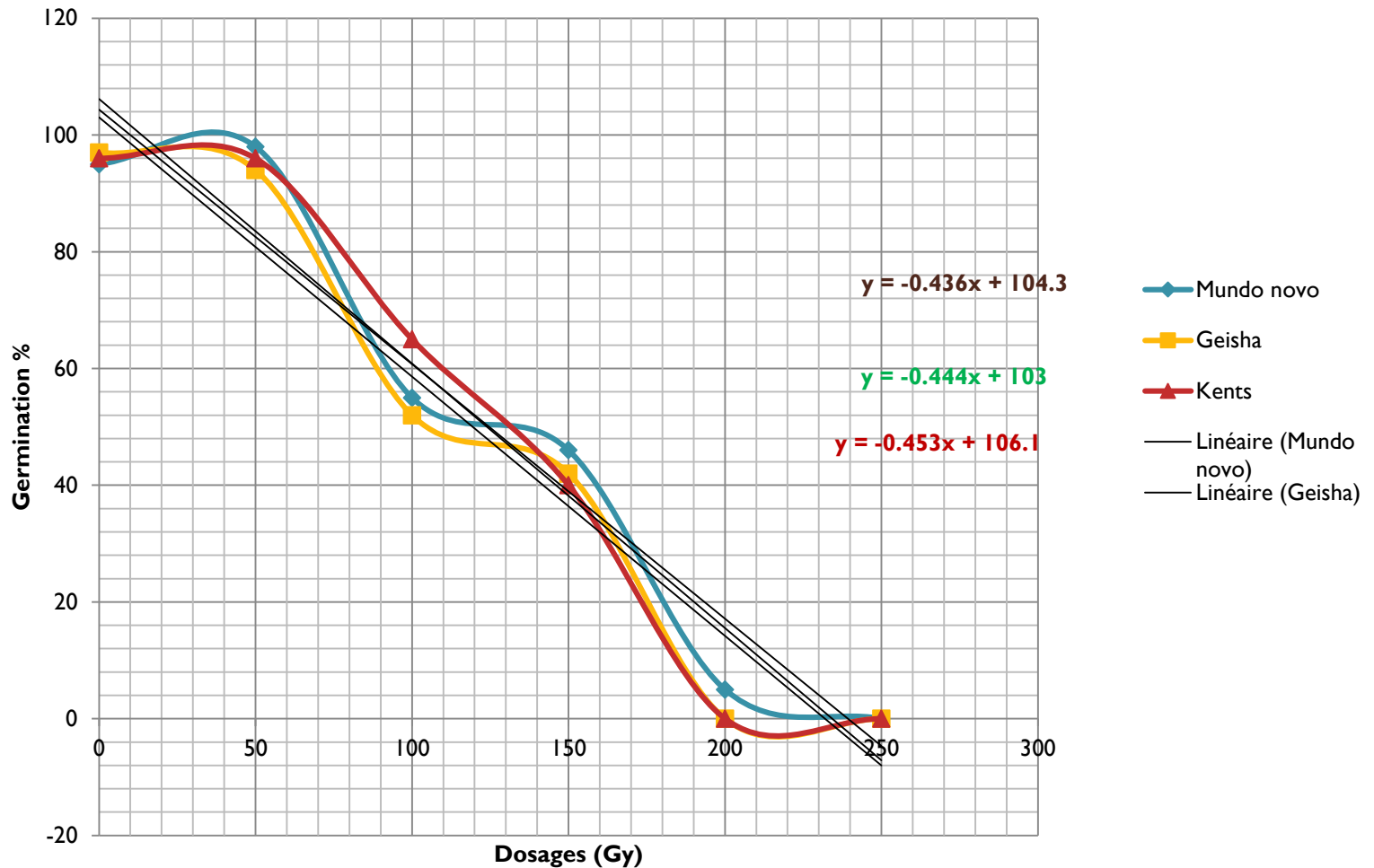
Result (Seeds)

- Cultivars were inversely proportional to the emergence of the radicle.
- All treated seeds developed hypocotyls.
- The optimal mutation induction dose for seeds (LD_{50}) were within 120 Gy for the Gamma irradiation

Germination trends



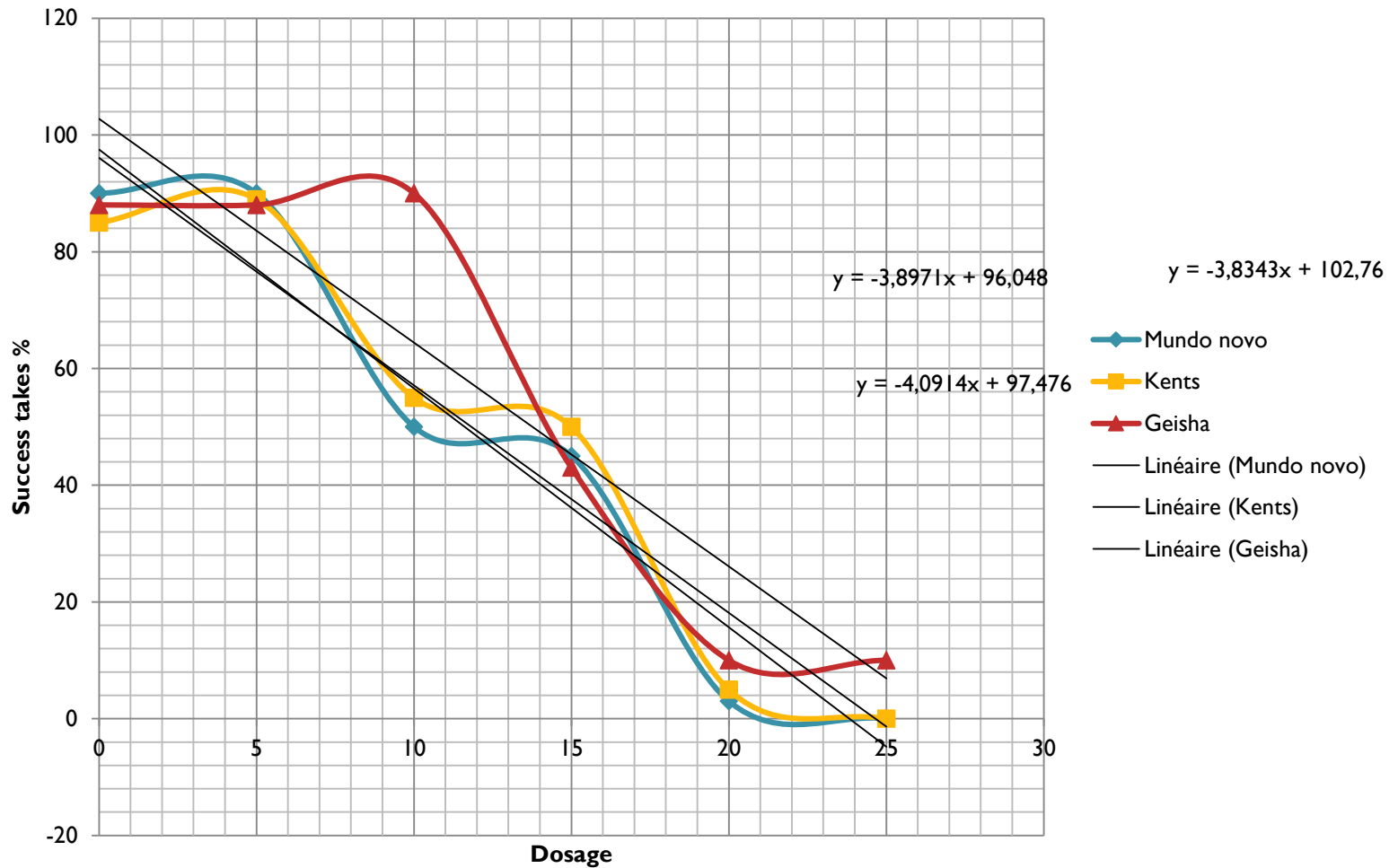
Radiosensitivity Test Seed LD/50



Result Contd. (In vivo cuttings)

- Success takes commence 4 WAS
- Complete success takes 8 weeks with additional 4 weeks of hardening
- About 90% of success takes at 0 and 5 Gy with a stimulation in Geisha variety
- At 15Gy the success takes was between 53 to 45%
- LD/50 was within 12Gy of irradiation

Radio sensitivity Cuttings (LD/50)



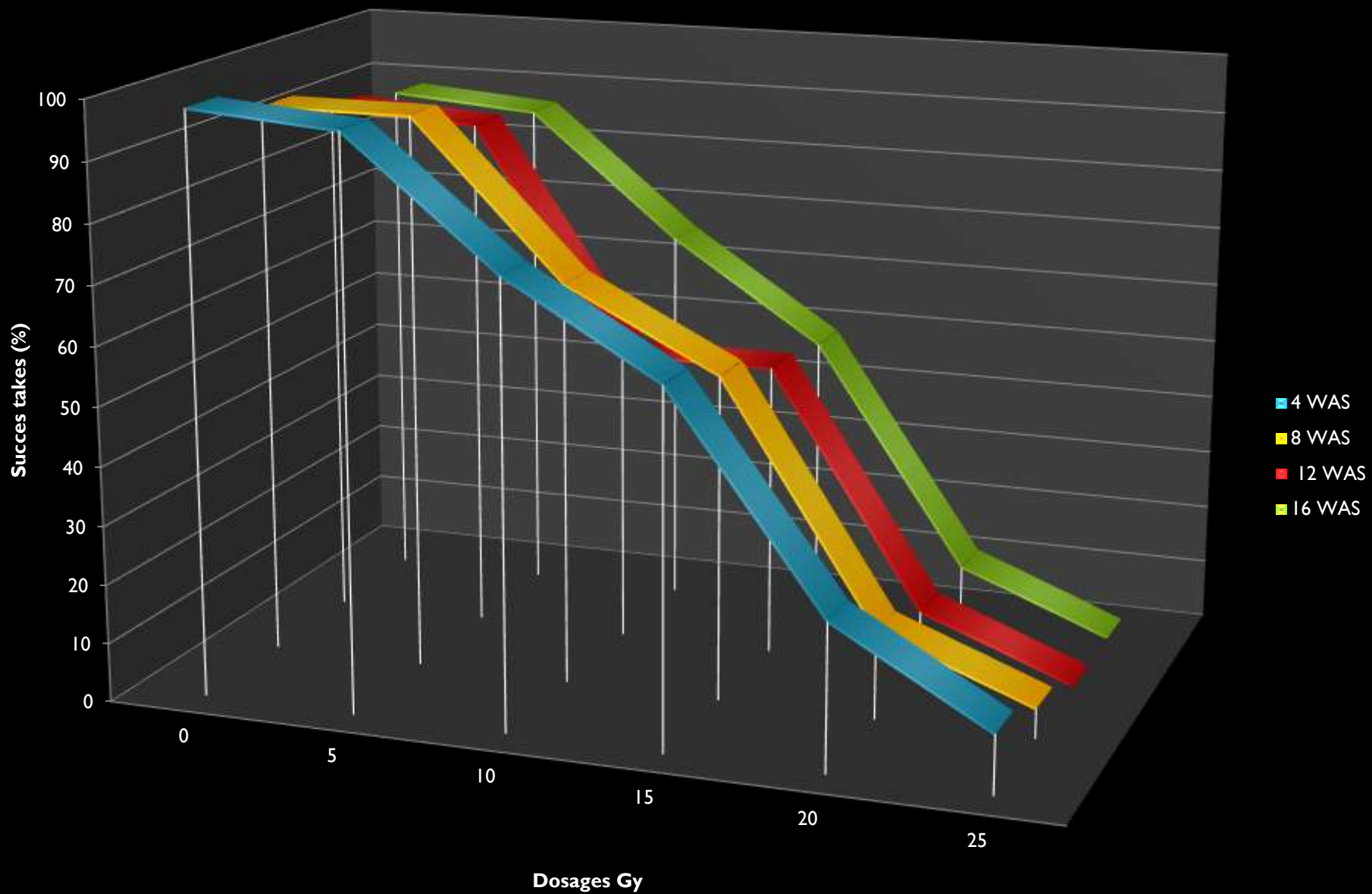
Mean separation of four characters of Arabica genotypes

Genotype	PH(cm)	RL(cm)	NR	NL
Mundo novo	14.02 ^a	9.86 ^a	4.00 ^a	5.00 ^a
Kents	11.20 ^b	6.70 ^b	4.00 ^a	4.00 ^b
Geisha	14.03 ^a	9.86 ^a	4.00 ^a	5.00 ^a

Plant Height =PH, Root length= RL, Number of root=N.R= Number of root and N.L=Number of leaves.

At 5% of significance

Success takes



Conclusion

- The project is ongoing with some phenotypic character
- Somatic embryogenesis for multiple production is the next stage
- For Multi locational trial

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Thank You
For
Listening

