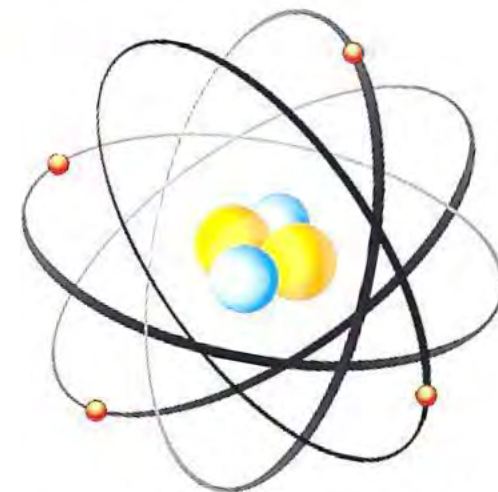




Effects of Gamma irradiation on *in vitro* Culture of vetiver



Katarut Chusreeaeom, Ph.D

**Department of Applied Radiation and Isotopes,
Faculty of Science, Kasetsart University**





introduction



Vetiver

Utilization for soil and water conservation



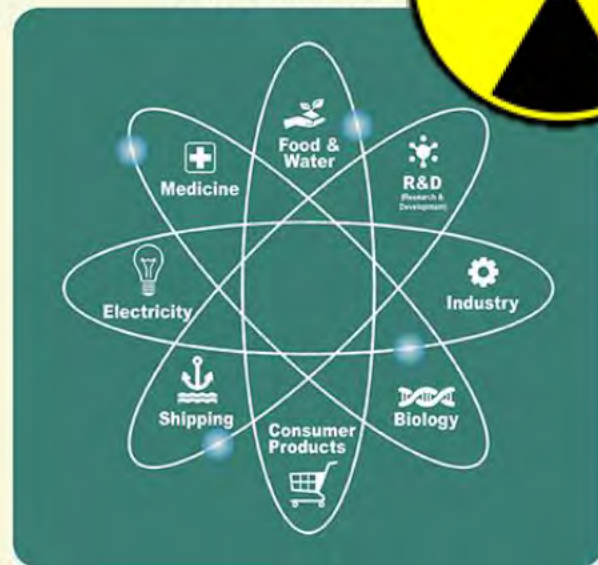
- ☐ slope stabilization and erosion protection
- ☐ Improve soil fertility and preserve soil moisture
- ☐ phytoremediation applications
- ☐ etc.



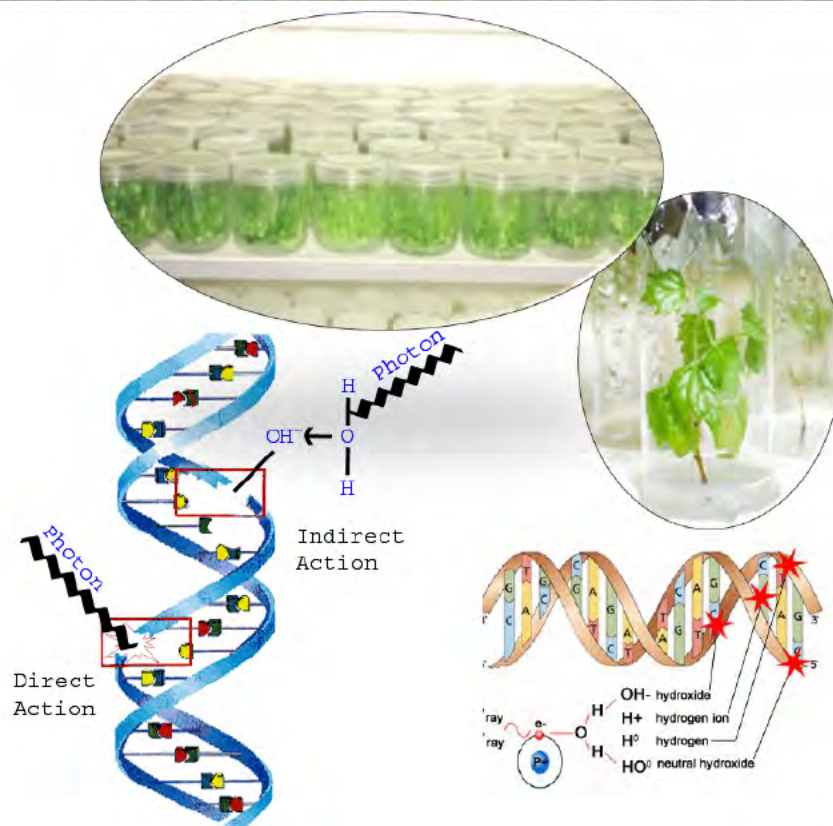


introduction

Uses of Nuclear Technology



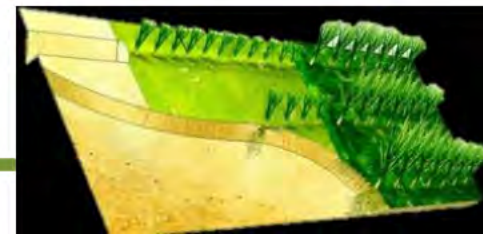
nuclearenergy.ir



Nuclear technology

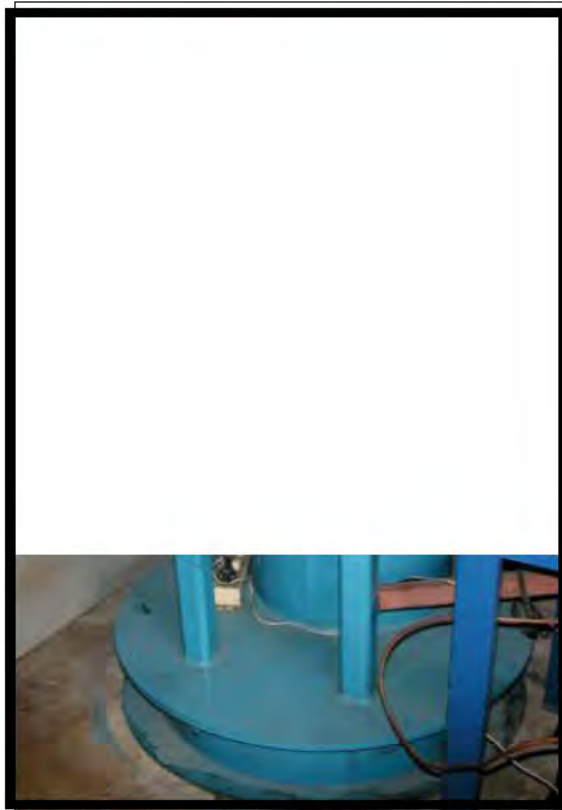
in vitro mutagenesis

Gamma
ray





Facilities at NTRC, Kasetsart University



**Mark I Gamma Irradiator
for acute irradiation**



**Gamma Room for
Chronic Irradiation**





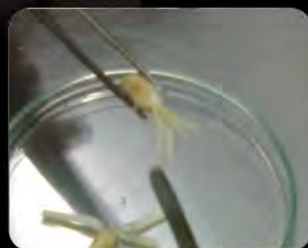
Objective

- ❑ To investigate the effect of acute and chronic gamma irradiation on the survival and proliferation rate as well as tillering character of the two native Thai vetivers
- ❑ To study the effect of mutagenesis to the native Thai vetiver plantlets grown in tissue culture
- ❑ To estimate of the 50% lethal dose (LD_{50}) and 50% growth reduction dose (GR_{50}) using as indicators for vetiver radiosensitivity





Materials and Methods



The explants
were cultured
on MS medium



The native thai vetiver

- ❑ *Chrysopogon nemoralis*,
the Nakorn sawan ecotype
- ❑ *Chrysopogon zizanioides*,
the Song kha3 ecotype





Materials and Methods

Acute gamma-irradiation

Mark I Gamma Irradiator

in vitro vetiver plantlets

- ☐ Nakorn sawan
- ☐ Songkha3



gamma irradiation

- ☐ 0, 15, 30, 45, 60, 75 and 90 Gy





Materials and Methods

Chronic gamma-irradiation

in vitro vetiver plantlets

- ☐ Nakorn sawan
- ☐ Songkha3



Gamma room

gamma irradiation

0, 33.6, 74.1, 107.8, 141.2, 174.8
and 215.3 Gy.

(Dose rate of 0.84 Gy/hr)





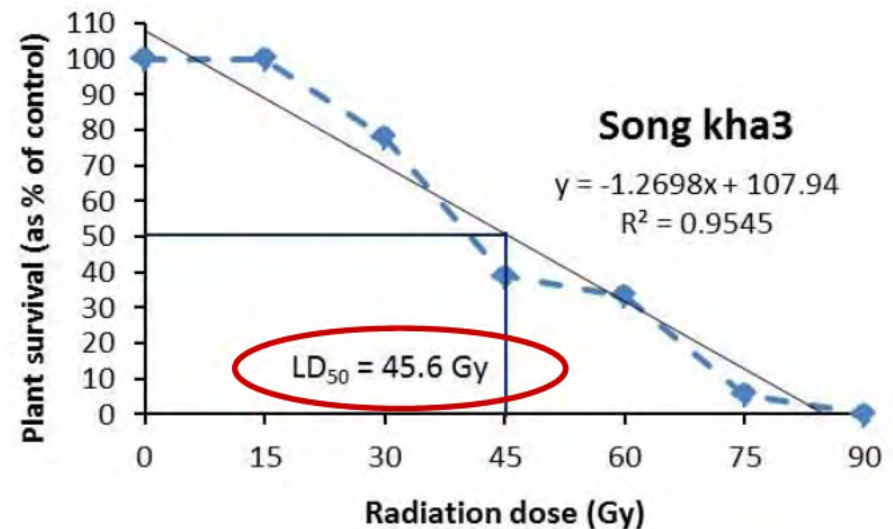
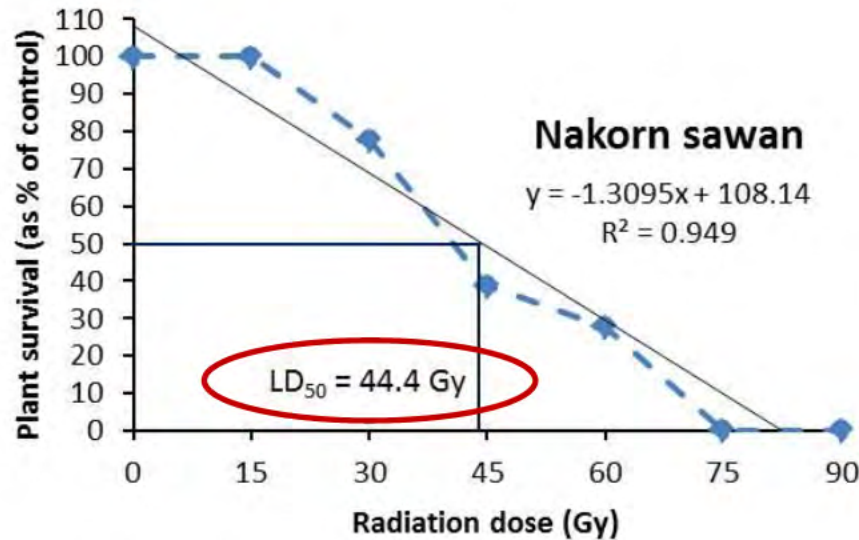
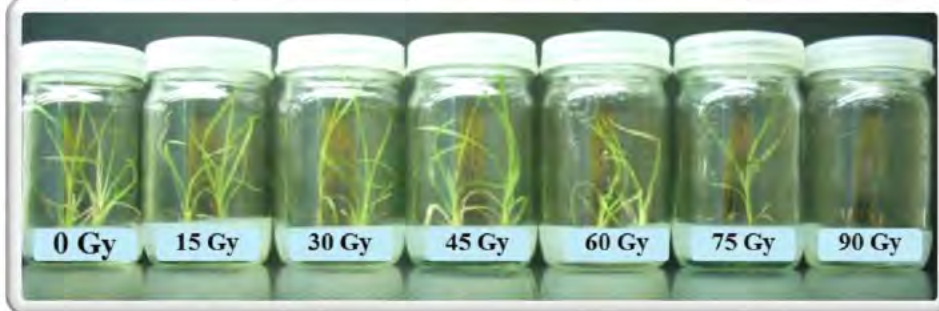
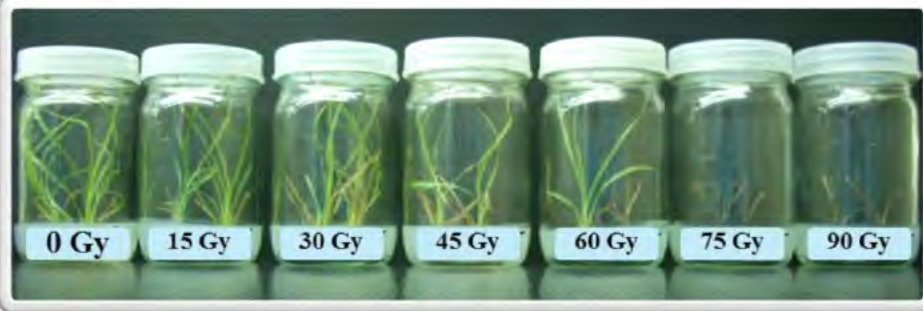
Results

- ❑ Effects of acute gamma- irradiation
 - plant survival rate
 - plant proliferation rate
- ❑ Effects of chronic gamma- irradiation
 - plant survival rate
 - plant proliferation rate
- ❑ Growth performance in M_1V_2 generation





Effects of **acute** irradiation on plant survival rate

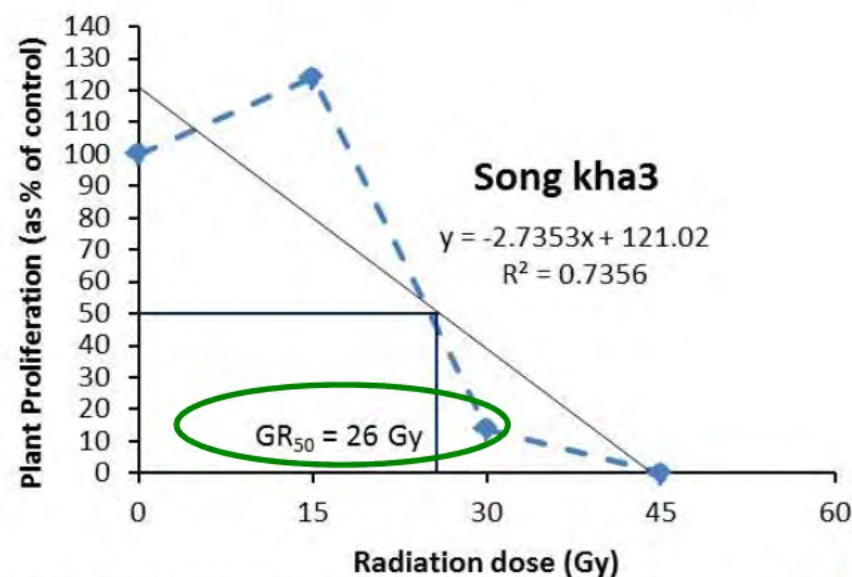
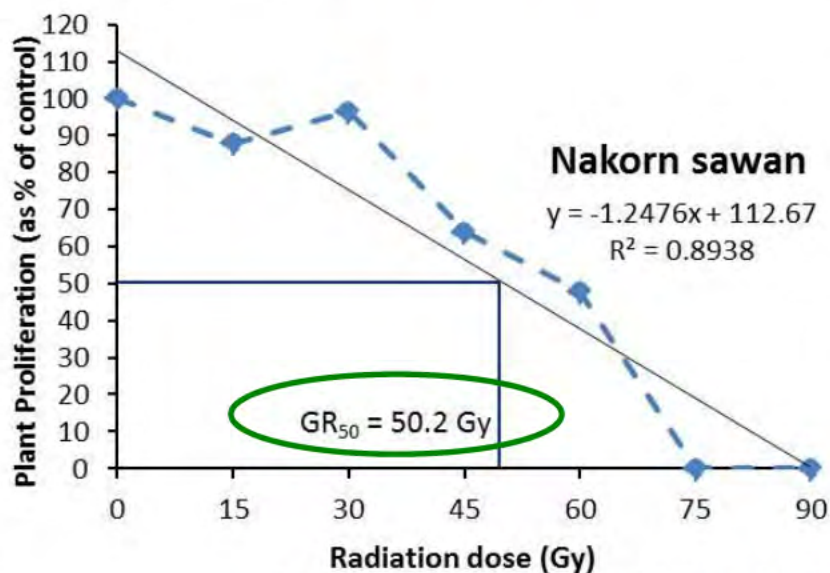
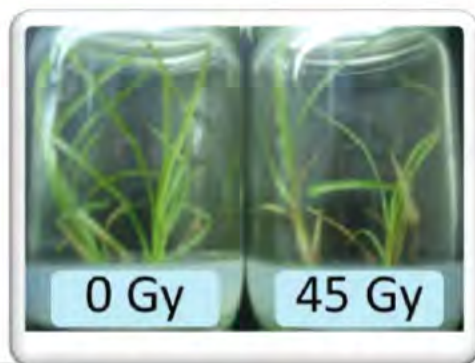


1/ data within columns, means followed by a common letter are not significantly different at the 5% level by DMRT





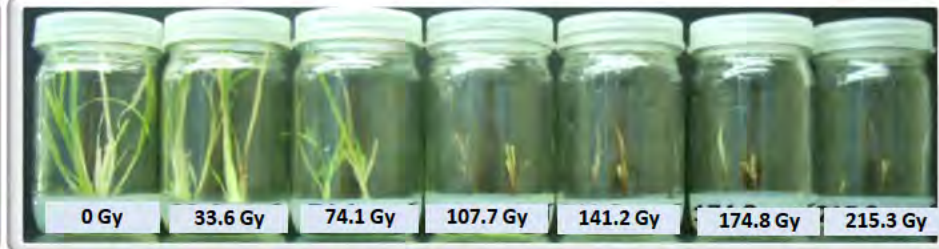
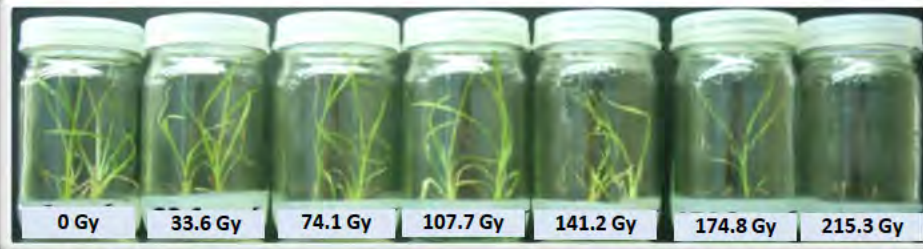
Effects of **acute** irradiation on plant proliferation rate



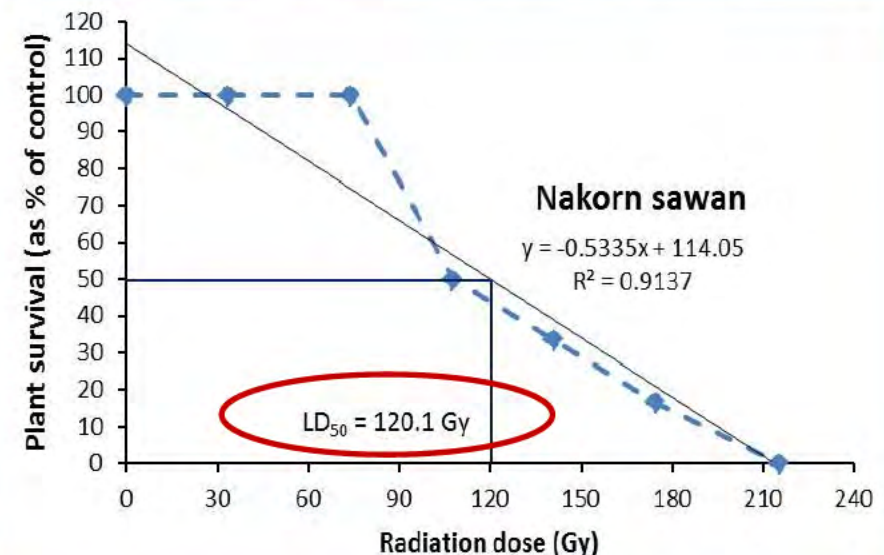
data within columns, means followed by a common letter are not significantly different at the 5% level by DMRT



Effects of **chronic** irradiation on plant survival rate



Gamma dose (Gy)	Total no. of irradiated plantlets	Nakorn sawan ecotype	
		No. of survival plantlets	Survival (% of control)
0	18	18	100 a
33.6	18	18	100 a
74.1	18	18	100 a
107.7	18	9	50 b
141.2	18	6	33.3 bc
174.8	18	3	16.7 bc
215.3	18	0	0 c
F-test			*
C.V. (%)			39.75



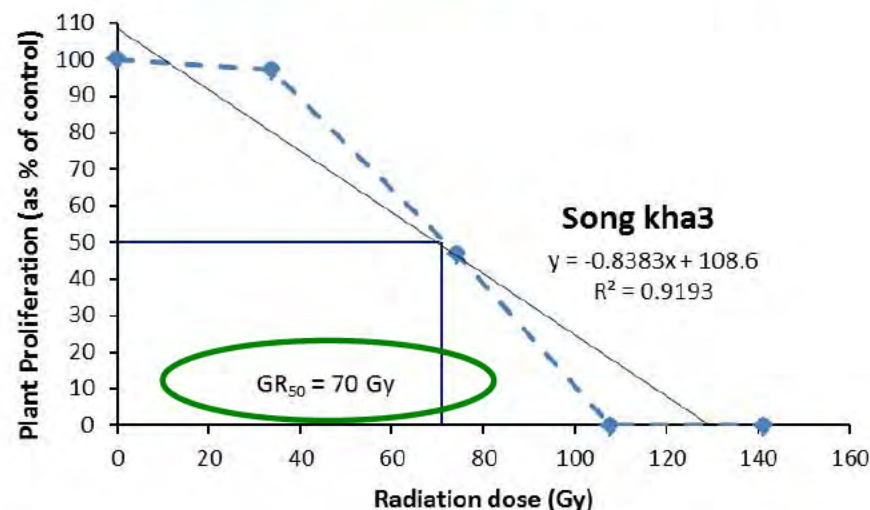
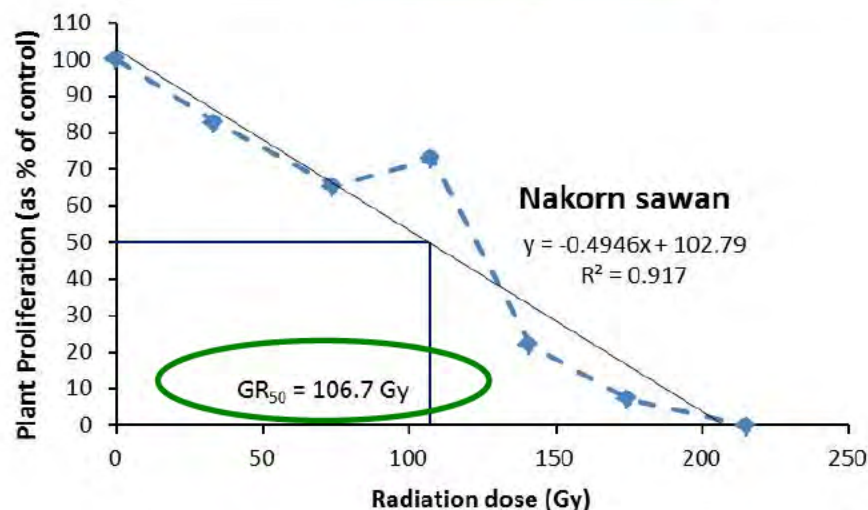
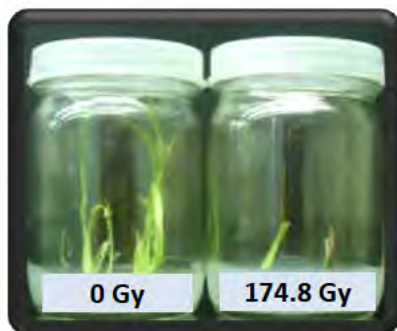
* significant at 5% level

1/ data within columns, means followed by a common letter are not significantly different at the 5% level by DMRT





Effects of **chronic** irradiation on the proliferation rate



C.V. (%)

51.90

29.85

* significant at 5% level

1/ data within columns, means followed by a common letter are not significantly different at the 5% level by DMRT





Tillering character in M_1V_2 generation

Acute gamma-irradiation

Gamma dose (Gy)	Nakorn sawan ecotype				Song kha3 ecotype			
	15 days	30 days	45 days	60 days	15 days	30 days	45 days	60 days
0	0	0.88 a	1.27 a	1.88 a	0	1.00 a	2.38 a	2.61 a
15	0	0.33 c	0.77 a	1.33 c	0	0.61 ab	0.88 b	1.44 b
30	0	0.16 d	0.44 a	0.88 d	0	0.35 b	0.71 c	1.00 c
45	0	0.16 d	0.61 a	0.83 d	-	-	-	-
60	0	0.50 b	1.00 b	1.50 b	-	-	-	-
F-test	ns	*	*	*	ns	*	*	*
C.V. (%)	0	11.01	47.63	6.97	0	44.09	0	1.87

ns non-significant

* significant at 5% level

1/ data within columns, means followed by a common letter are not significantly different at the 5% level by DMRT





Growth performance in M_1V_2 generation

Nakorn sawan ecotype (acute irradiation)

0 Gy



Control



30 Gy



45 Gy



60 Gy



Alteration in Leave morphology

- ☐ The radiation associated with *in vitro* culture could induce mutation in short time
- ☐ The lower dose rate of radiation probably caused little damage to the plants' genetic material
- ☐ The cells could repair themselves by DNA repair mechanism





Tillering character in M_1V_2 generation

Chronic gamma-irradiation

Gamma dose (Gy)	Nakorn sawan ecotype			
	15 days	30 days	45 days	60 days
0	0	0.38 b	0.55 ab	0.66 b
33.6	0	0.22 de	0.27 b	0.33 c
74.1	0	0.27 cd	0.66 ab	0.72 b
107.7	0	0.10 e	0.50 ab	0.70 b
141.2	0	0.33 bc	1.00 a	1.16 a
174.8	0	0.50 a	0.27 b	1.00 a
F-test	ns	*	*	*
C.V. (%)	0	16.95	42.08	40.74

ns non-significant

* significant at 5% level

1/ data within columns, means followed by a common letter are not significantly different at the 5% level by DMRT

Physiological changes in plants exposed to gamma rays

- enhancement or inhibition of germination, seedling growth, and other biological responses and affected in generating in **tiller number** and **plant height**. (Kim *et al.*, 2000; Wi *et al.*, 2005; Silveira *et al.* 2014).

The potential mutant of the Nakorn sawan ecotype was the tillering efficiency





Conclusion

- ❑ This study provided the information of $LD_{50/60}$ and $GR_{50/60}$ values combined with tissue culture technique could contribute potentially towards crop improvement in vetiver

	Nakorn sawan		Song kha3	
	Acute	Chronic	Acute	Chronic
$LD_{50/60}$	44.4 Gy	120.1 Gy	45.6 Gy	-
$GR_{50/60}$	50.2 Gy	106.7 Gy	26.0 Gy	70.0 Gy





Conclusion

- ❑ The experimental results of the $LD_{50/60}$ and the $GR_{50/60}$ not only implied the radiosensitivity difference in the irradiation methods but also the vetiver ecotypes.
- ❑ The potential mutants of the native Thai vetivers in this research were the tillering efficiency of the Nakorn sawan ecotypes.





Acknowledgement

- Prof.Dr. Nualchavee Roongtanakiat
- Assoc.Prof. Dr. Peeranuch Jompuk
- Ms.Sirintorn Warin
- Nuclear Technology Research Center
- Office of the Royal Development Projects Board





introduction



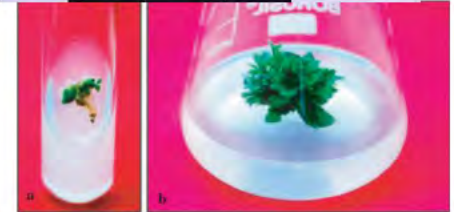
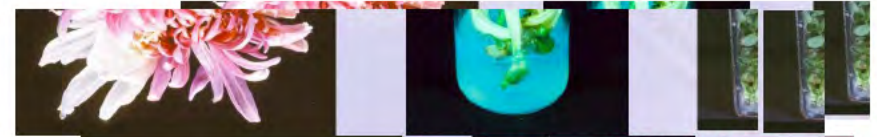
Rice



Sugarcane



Aquatic plant



Chrysanthemum

