

# Effect of Different Mutagenic Treatments on Morphological Traits of M2 Generation of Soybean

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## Introduction

Despite the richness of the soybean germplasm collection the genetic base of the present day collection remains poor ([Delannay et al., 1983](#)). Present investigation was, therefore, undertaken to obtain information on effect of  $\gamma$ -irradiation and sodium azide as well as their combination on morphological traits of the M2 generation of two soybean cultivars Tolena and Toping.

## Materials and Methods

The soybean cultivars Tolena and Toping were used in this experiment (Zeainvent Ltd, Slovakia). Both physical and chemical mutagens as well as their combination were used for induction of mutations. The chemical mutagen applied was sodium azide (NaN<sub>3</sub>) from Fluka, while the physical mutagen was  $\gamma$ -irradiation. Dry seeds were treated with 0, 80, 160, 240, 320 and 400 Gy of  $\gamma$ -radiation and/or with a 1mM solution of sodium azide. Soybean seeds were irradiated and soaked subsequently in 1mM solution of sodium azide for 24 hours at room temperature and in the dark. The treated seeds were sown in the field in May 1995, whereas the subsequent seeds of the M1 generation in May 1996.

All M2 plants were analyzed with regard to such morphological properties as height of plant, height of the lowest pod setting, number of branches, number of sterile nodes, number of seeds on a whole plant and weight of 100 seeds. The main stem was analyzed for the number of fertile nodes, number of pods, number of absent seeds, number of seeds and weight of seeds. The same morphological properties as on the main stem were also analyzed on branches.

## Results and Discussion

Application of physical and chemical mutagens to plants may eventually lead to useful mutant plant lines. A number of chemical and physical mutagens have been applied to soybean ([Katoh et al., 1992; 1993; 1994; 1995](#); [Baoge et al., 1995](#); [Böhmová and Gajdošová, 1993](#); [Rahman et al., 1994; 1995](#); [Byun et al., 1993; 1995](#)). There are papers dealing with analysis of M2 and M3 generation of soybean induced by physical mutagens and chemical mutagens ([Borejko, 1970](#); [Lee et al., 1968](#)).

In our experiments, the Tolena and Toping cultivars seem to differ with regard to sensitivity to mutagenic treatments. Cultivar Tolena seems to be more sensitive to mutagenic treatment than the cultivar Toping. Treatments of Tolena cultivar with 160 Gy in combination with sodium azide, 240 Gy, 320 Gy, 400 Gy as well as their combinations with sodium azide were lethal, so there were no progeny in the M2 generation. In the case of the cultivar Toping, only treatments with 240 Gy plus sodium azide and 400 Gy, as well as those treatments in combination with sodium azide were lethal to the M2 generation. All investigated morphological properties of the M2 generation for cultivars Tolena and Toping are given in [tables 1](#) and [2](#). As evidenced from data presented in [Table 1](#), treatments with 160 Gy reduced height of M2 Tolena plants. Among analyzed M2 plants of the Toping cultivar there was no evidence of decreased plant height with an increasing dose of  $\gamma$ -irradiation. Investigated Toping plants of the M2 generation showed no significant changes in plant height regardless of mutagenic treatment ([Table 2](#)).

As evidenced from the presented data, combination of  $\gamma$ -irradiation with sodium azide seems to be more lethal to soybean plants than separate treatments with these mutagens.

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**Table 1. Morphological analysis of M2 Tolena plants following their treatment with 1mM sodium azide (ch) and with a combined treatment with different doses of  $\gamma$ -irradiation and 1 mM sodium azide (Gy ch).  $\gamma$ -irradiation and 1 mM sodium azide (Gy ch).**

		Mutagenic treatment <sup>a</sup>				
		Control	ch	80Gy ch	80Gy	160Gy
Whole Plant	Height of plant (cm)	76±14	77±12	71±9	75±15	59±6
	Height of the lowest pod (cm)	12±5	10±2	12±4	11±3	9±4
	Number of branches	2±2	3±1	4±1	3±2	4±3
	Number of sterile nodes	5±3	7±3	7±4	6±3	8±5

	Number of seeds	56±26	64±27	67±32	65±45	57±32
	Weight of 100 seeds (g)	18.6±2.3	19.8±2.4	19.6±2.7	20.8±3	20.8±2.5
Main Stem	Number of fertile nodes	9±2	9±2	8±2	9±3	8±2
	Number of pods	19±5	17±5	16±6	18±8	15±7
	Number of absent seeds	8±4	8±4	9±6	10±5	9±5
	Number of seeds	35±11	33±10	30±12	33±17	23±12
	Weight of seeds (g)	6.6±2.2	6.7±2	6±3	6.9±3.2	4.7±2.5
Branches	Number of fertile nodes	10±7	13±6	14±7	14±9	16±11
	Number of pods	14±11	19±10	21±12	22±18	23±14
	Number of absent seeds	8±7	9±7	11±9	11±7	12±8
	Number of seeds	25±21	33±19	38±23	37±33	35±24
	Weight of seeds (g)	4.8±4.4	6.5±3.9	7.1±4.4	7.9±7.4	7.2±5.2
	Number of analyzed plants	30	30	30	30	30
a: Mean value ± standard deviation						

**Table 2. Morphological analysis of M2 Topping plants following their treatment with 1 mM sodium azide (ch) and with a combined treatment with different doses of g-irradiation and 1 mM sodium azide (Gy ch).**

		Mutagenic treatment <sup>a</sup>								
		Control	ch	80Gy ch	80Gy	160Gy	160Gy ch	240Gy	320Gy	320Gy ch
Whole plant	Height of plant (cm)	58±10	67±5	69±5	57±7	63±7	64±6	63±8	61±9	55±9
	Height of the lowest pod(cm)	7±2	6±2	6±2	7±2	7±3	6±2	7±2	6±2	6±2
	Number of branches	1±0.9	2±1	2±1	2±1	2±1	2±1	2±1	2±1	3±3
	Number of sterile nodes	3±2	4±2	3±2	4±3	4±3	4±2	5±3	6±4	10±3
	Number of seeds	57±35	91±40	76±28	76±27	60±28	97±46	44±34	56±46	91±53
	Weight of 100 seeds (g)	14.4±3.2	15.9±4.0	15.3±2.7	16.0±3.2	15.4±3.3	18.3±3.5	16.2±4.0	17.0±4.0	20.8±21
Main stem	Number of fertile nodes	9±2	11±2	10±2	9±3	9±3	11±2	7±3	8±3	10±3
	Number of pods	20±8	28±6	26±5	23±8	21±7	31±9	16±8	18±9	24±12
	Number of absent seeds	5±2	7±3	6±3	8±4	5±3	11±6	4±3	5±4	6±4
	Number of seeds	40±18	57±16	52±12	46±18	39±15	54±18	28±17	31±20	45±24
	Weight of seeds (g)	5.8±3	9.3±3.9	8.0±2.6	7.2±2.6	6.1±2.8	10.1±4.4	4.4±2.7	5.3±3.8	13.8±26
Branches	Number of fertile nodes	6±5	9±7	7±4	10±6	8±6	14±9	6±5	9±6	12±7
	Number of pods	11±11	21±18	14±11	19±13	13±9	29±22	11±11	18±14	26±17

	Number of absent seeds	6±5	7±5	5±3	8±6	5±3	11±10	4±5	6±5	8±6
	Number of seeds	21±21	39±35	28±22	34±26	23±17	47±37	19±22	30±29	49±33
	Weight of seeds (g)	3.3±3.2	6.4±6.7	4.6±4.1	5.6±5.0	3.5±2.5	8.6±7	3±4	5±6	7.9±6.3
	Number of analyzed plants	30	30	30	30	30	30	30	30	16
a: Mean value ± standard deviation										