IAEA RAS5070-9003 :

"Developing Bioenergy Crops to Optimize Marginal Land Productivity through Mutation Breeding and Related Techniques (RCA)"

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Progress report on rapeseed mutation breeding in Mongolia

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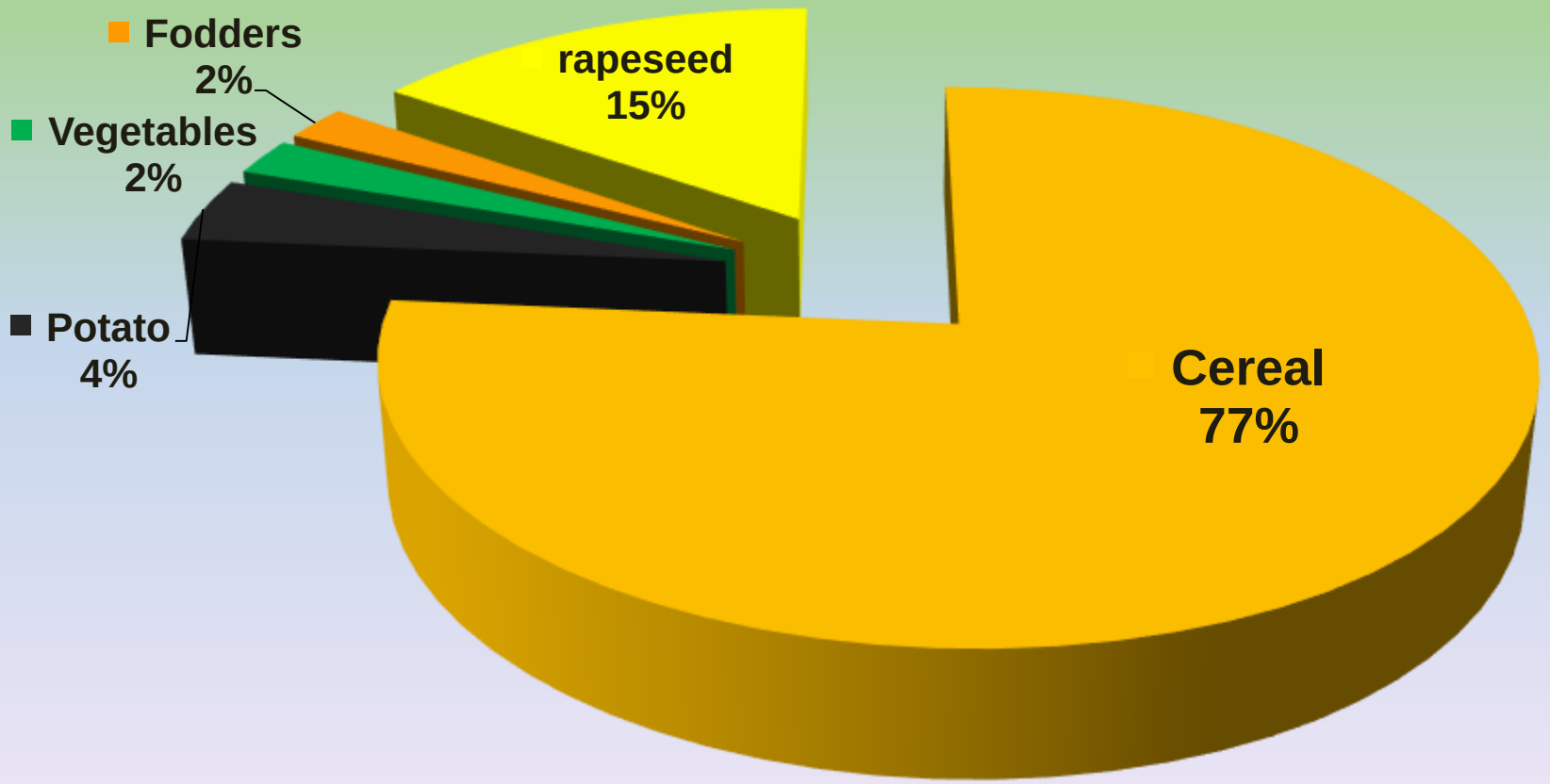
CROP PRODUCTION



Challenges in bioenergy crop cultivation

- **Rapeseed is new crop with rapid extension**
- **Export oriented**
- **Entire cultivation dependent on foreign varieties, new potential local; varieties required**
- **Seed sources are not stable and low quality and imported**
- **Local seed production system is not established**
- **Farmers are not experienced growing oil crop**
- **No studies on impact of rapeseed to soil quality**

PROJECT OBJECTIVE

To develop drought tolerant rapeseed mutants adaptable to drought prone areas and improve water and nutrient use efficiency of new mutants.

The EXPERIMENTS: The 2 experiments have been conducted:

Experiment 1: Improvement rapeseed varieties through mutation treatment

Experiment 2: The effect of nitrogen fertilizer to rapeseed mutants

Research team

Counterpart name Mr. Bayarsukh Noov

Institution: Institute of Plant and Agricultural Science. (IPAS)

Project Team:

Ms.Dolgor. Ts,	mutation breeding
Ms.Uugantsetseg,	mutation breeding
Mr.Otgonbayar.B,	molecular biology
Dr. D.Tuul,	Soil and agro-chemistry
Mr. Zandraagombo	soil and stress tolerance
Ms.Urtnasan. G,	plant biochemistry

Target

1. Both canola type Br.napus and Br.juncea varieties selected as target,

2. **Target trait is drought** tolerance, high yield,

3. Impact of rapeseed varieties to soil fertility

4. Improve water and Nutrient-use Efficiencies of rapeseed mutants

Activities on breeding

2015

- Treatment of seeds by gamma ray and chemical mutagenesis
- Generation of M1 population.

2016

- Screening of M2 generation
- Selection of desirable traits among segregating population.

Materials and methods

- The rapeseed varieties which has been selected through variety test including Domo (Brassica juncea), Westar (Brassica napus) for the determination of optimal dose of mutagen treatments.

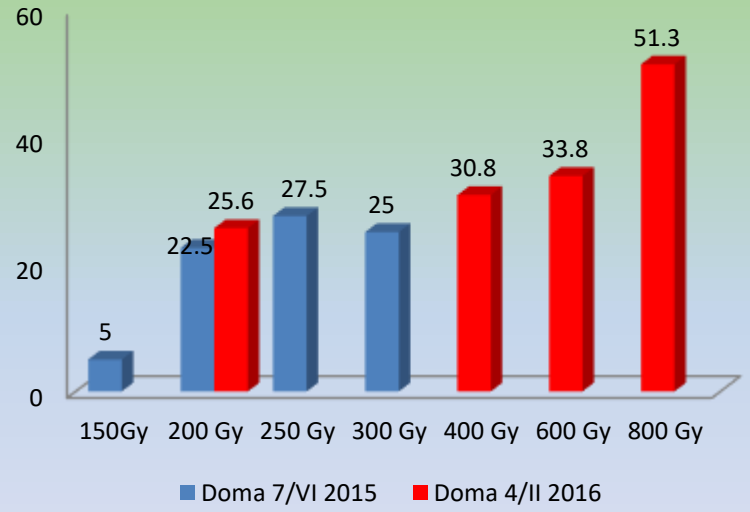
- The mutagen treatment used are gamma ray and NaN3. The seeds treated by gamma ray in dosage between 150Gy-800Gy at Siebersdorf Austria and Institute of Crop Science (ICS) Mutation breeding center in Beijing, in 2015.

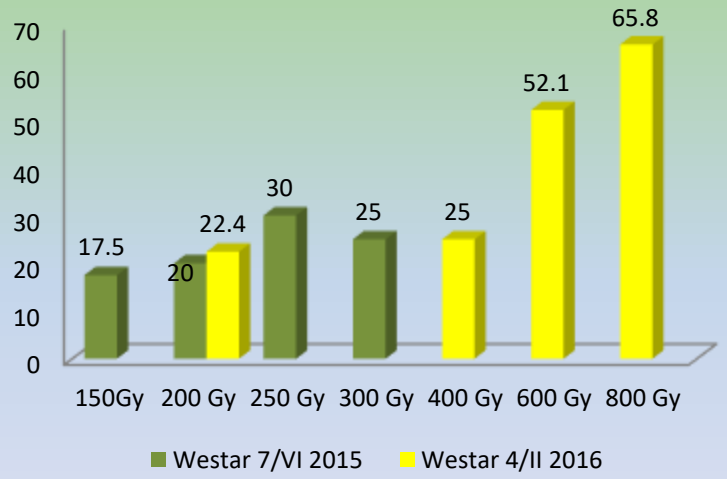
- The chemical treatment by NaN3 had been applied at IPAS Mongolia.

- The irradiated materials were sown in 1m x 2 m plot. Randomized Complete Block Design (RCBD) with 3 replications was used in the experiment. Weeding and control of insect pests were done as necessary. Selection of plants with desirable agronomic.

PROGRESS ON GOING ACTIVITIES OF RAS5070 IN MONGOLIA

OPTIMAL DOSE DETERMINATION

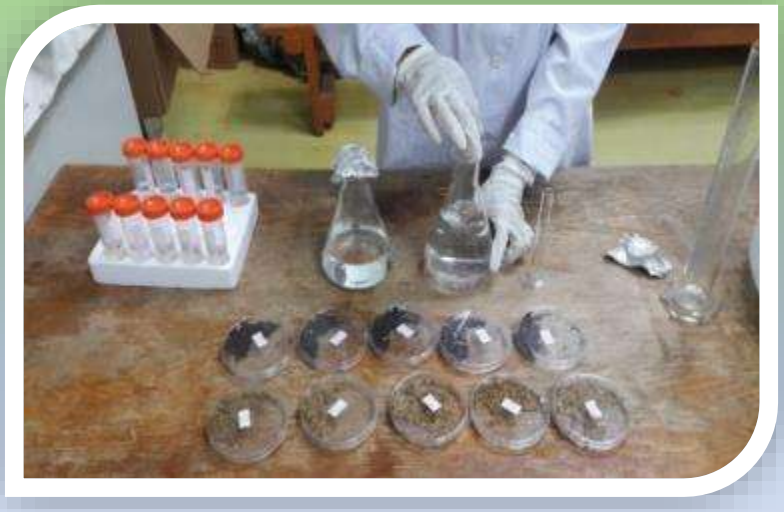




In 2015, the optimal gamma ray dose identified for Domo (Brassica juncea) is 800Gy and for Westar, (Brassica napus) is 600Gy.

Also, an optimal dose of sodium azide (NaN3) for Domo and Westar is identified as 4.0 mM.

LABORATORY EXPERIMENT for M1



Field screening M1

The irradiated rapeseeds were sown at breeding plot of IPAS in Darkhan-Uul in May 2015, along with parents.

Standard agronomic practices were followed to grow the M_1 generation.

Visual observations were recorded in M_1 population of Domo and Westar. The seed harvested in bulk for each treatment.

Selection of mutant progenies M2

In 2016, the M_1 seeds of the 216 mutant lines of (Domo and Westar varieties) grown in $M_{2\,I}$ on $2m^2$ in 3 replications.

The selection practised to isolate mutants with early maturity, short plant height, pod size and seed size.

Totally 431 plants have been selected in M_2 including 125 plants by pod shape, 12 plants by early maturity, 258 plants by number of seeds in pod, 36 plants by short plant height.

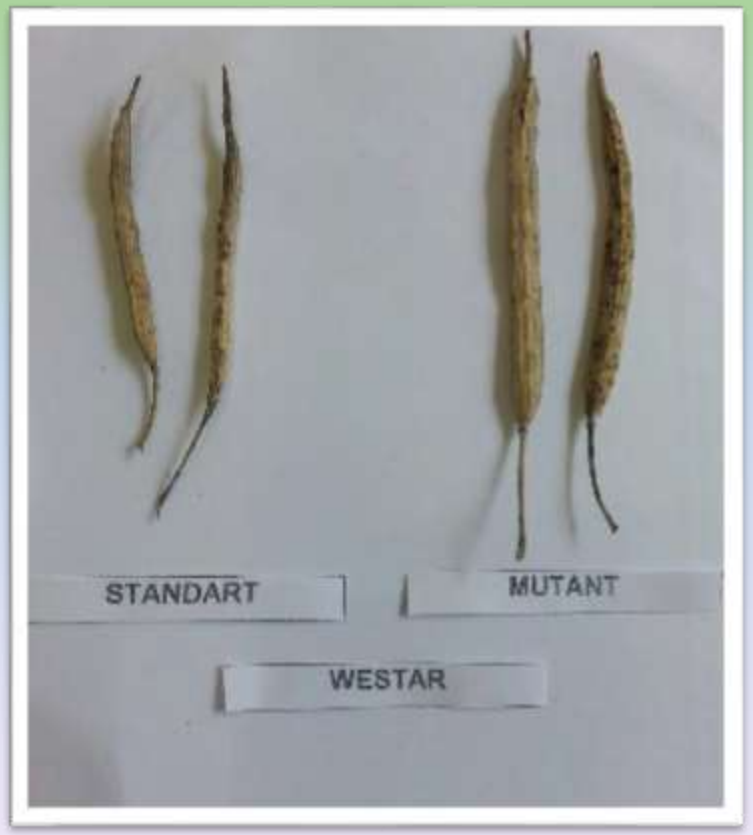
Control	Physical treatment	Chemical 2.0mM	Chemical 4.0mM	Total
Doma	69	69	74	212
Westar	64	79	76	219
Total	133	148	150	431

FIELD EXPERIMENT for M2

Selected characters of mutants

Varieties		Maturity day	Number of pod per plant	Plant height, cm
Doma	Control	110-112	102-162	112-125
	Mutant	104-111	128-429	105-120
Westar	Control	110-114	49-126	110-130
	Mutant	105-108	77-200	100-126

Selected characters of mutants



LESSON LEARNED

- This was first time work with rapeseed mutant
- The not enough experience on selection of rapeseed mutants by desired characters and making isolation were challenging for Mongolian team.
- Experts are needed to further continue on further selection of rapeseed mutants with desired characters and screening for drought tolerance.

Project work plan 2017-2018

Improvement rapeseed varieties through mutation treatment 2017-2018

In 2017, the selected M_2 mutant population sown as plant to row.

From the M_3 population, the early maturity, short plant height, potential grain yield would be selected.

In 2018, the evaluation on the drought tolerance would be carried out both in open field and laboratory condition (PEG).

Individual plant selections will be made for M_4 generation.

Experiment on EBD Farming Technology

Objective: To study effect of EDB farming technology to wheat seed production in Mongolia

Crop: wheat

Variety; Darkhan- 34

Field location: North latitude 49°47', yeast Longitude: 105°45', Elevation ASL 705.5 m

Soil: Light clay chestnut soil. Typical common soil in central cropping zone Mongolia.

Experiment on EBD Farming Technology

Experiment design:

Control: Standard agronomic practices were followed to grow Wheat with recommended herbicides for weed control.

EBD installed:

Standard agronomic practices were followed to grow wheat. No fertilizer and herbicides applied.

Experiment on EBD Farming Technology

Installation of EBD stakes in the field:

EBD stakes on wheat seed multiplication field at IPAS experimental field on 3 June 2016.

We selected 40x40m plot and installed EBD unit following the provided instruction.

Experiment on EBD Farming Technology

Options	Plant height, cm	Productive tillers	Single spike		Seed purity %	1000 grain weight g
			Seed number	Seed weight, g		
EBD	100.3	176.3	40.0	1.45	83.1	36.75
Control	96.6	156.3	37.0	1.35	95.18	35.23

Thank you for attention