EFFECT OF LOW GAMMA IRRADIATION DOSES ON GROWTH AND PRODUCTIVITY OF GREEN BEAN

By

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B.Sc. Agric. Sc. (Horticulture), Ain Shams University, 2003

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Approval Sheet

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ABSTRACT

Amr Mohamed Mounir Farrag: Effect of Low Gamma Irradiation Doses on Growth and Productivity of Green Bean .Unpublished M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2011.

The field experiment was conducted within the two successive growing seasons of 2007/2008 and 2008/2009 to study the effect of low gamma irradiation doses (0, 10, 20, 30, 40, 50 and 60Gy) on growth and productivity of green bean cv. Bronco with 3 sowing dates 8, 18 and 28th of October in the first season and 30th of September, 10 and 20th of October in the second season.

The results of laboratory determinations showed that gamma irradiation doses did not affect the germination percent but slightly affected germination rate and electrical conductivity. Concerning field experiment, data revealed that green bean plant vegetative growth, i.e., plant height, fresh and dry weight, leaf number and leaf area, at 45 days after planting (DAP) and shoot number at 30, 45 DAP recorded significantly the highest values at the first sowing date in both seasons.

With respect of gamma irradiation doses, all the previously mentioned parameters of plant vegetative growth recorded the highest values with 40 Gy at 15, 30, and 45 DAP except number of leaves which recorded the highest value with 30Gy at 15, 30 and 45 DAP. Concerning shoot number there was no significant difference among several doses at 30 DAP in the first season but in the second season it was 20 Gy and at 45 DAP compared with the control.

Also the first sowing date in both seasons gave the highest pod length, fresh and dry weight, plant yield, number of pods per plant, marketable yield per plot and total yield per feddan. Whereas ,the second sowing date led to the lowest pod thickness. In addition, 20Gy of gamma irradiation doses recorded the highest value of pod length .The 30 Gy dose showed the highest value of pod fresh and dry weight, plant yield and total yield per feddan. In addition ,the 20 and 30 Gy doses led to the

highest pod number per plant and marketable yield, concerning pod thickness there was slight difference only in the second season between several doses.

The second sowing date in the first season and the third sowing date in the second season positively increased total sugars in leaves, and the first sowing date increased the total chlorophyll reading in leaves and protein in green pods, the second sowing date in first season and the third sowing date in second season led to the lowest percentage of fibers in green pods and there was no significant difference between the second and the third sowing date in the second season. Gamma irradiation at 20 Gy dose recorded the highest values of protein in green pods and 60 Gy dose increased total sugars and total chlorophyll reading in leaves whereas 20,30,40,50 and 60 Gy doses led to the highest percent of fibers in green pods and the control scored the lowest.

Key Words:

Green bean, sowing date, gamma irradiation,growth,productivity.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning of abbreviation
A.O.A.C.	Association of official analytical chemists
Cm, Cms	Centimeter, Centimeters
cv., cvs	Cultivar, Cultivars
Fed	Feddan
g, gm	Gram
Kg	Kilogram
M	Meter
cm^2	Square centimeter
m^2	Square meter
mm	milimeter
DAP	Day after planting
Kr, Krad	Kilo rad = 1000 rad
R, r	Roentegn
Gy	Gray = 100 rad
K Gy, K Gray	Kilo Gray = 1000 Gray
^{60}CO	Cobalt 60
M1	First season
M2	Second season

1. INTRODUCTION

Snap bean (*Phaseolus vulgaris* L.*)* is an important vegetable crop in Egypt for local marketing and exportation, dry bean is an important protein source .Common bean is grown commercially to produce the green pods as well as the dry seeds.

Bean cultivated area for green pod production was 70516* fed. in 2009 and yielded 341321 tons with an average of 5 ton / fed. and the exported yield amounted to 28348 ton.

For increasing bean production to meet the increment in human population and exportation , increasing yield and quality can be achieved in winter season during low temperature under low tunnels which is expensive. However, it is wise to study the different planting dates to supply the market with abundant quantities for a long time .The improvement of both quantitative and qualitative traits of bean depends on the presence of the planting dates as reported by **Amer *et al.(*2002).**

Several studies have indicated that irradiation technique is of prime importance in agriculture for improvement not only the productivity of crop but also for increasing the nutritive value of food.

Gamma irradiation has been reported to induce favorable and remarkable effects on seed germination potential **(Rao,1999;Sinha *et al.*1999;Vinod and Mishra ,1999 ; WangzeNeng *et al*.,2000 ; Soliman and Abd El-Hamid ,2003).**The plant growth characteristics and yield were reported to be variously affected in consequence of gamma irradiation of seeds prior to sowing **(Bijit-Bhattacharyya *et al.*,1999;Kumar and Mishra,1999; Kurdali *et al*.,2000; Soliman and Abd El-Hamid ,2003).**

It is well known that the modification in plant growth and yield imposed by any of the environmental stresses is considered to be a

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*Department of Agricultural Statistics, Ministry of Agriculture and Land Reclamation, Egypt 2009.

reflection of certain alterations in some metabolic events in situe. Consequently, it is thought that seed irradiation may affect some of the biochemical regulatory mechanisms involved in seed germination and plant growth.

Therefore, the aim of this work was to study the effect of low gamma irradiation doses which have a stimulated effect on growth and productivity of green bean under the conditions of open field to reduce the cost of cultivation under low tunnels in early winter season.

2. REVIEW OF LITERATURE

In order to fulfill the objective of this study, the collected literature will be reviewed under the following main headings:

2.1. Effect of gamma irradiation:

2.1.1. Vegetative growth characters.

2.1.2. Pod yield and its components.

2.1.3. Chemical constituents.

2.2. Effect of sowing date:

2.2.1. Vegetative growth characters.

2.2.2. Pod yield and its components.

2.2.3. Chemical constituents.

2.1. Effect of gamma irradiation:

2.1.1. Vegetative growth characters

Badawi (1978) treated seeds of *Pisum sativum* L.cv.Little Marvel with eight doses of gamma rays (0-15000 r). It was reported that plant height and number of leaves per plant was not affected.

Shalaby *et al*. (1983) exposed cloves of Egyptian garlic cultivar Balady to different doses of gamma rays (250, 500, 1000,2000,4000,16000 and 32000 rad). The higher doses of gamma radiation (2000 rad or more) had an inhibitory effect on clove germination, cloves which were exposed to 2000 rad or more failed to continue to maturity. In the M1 generation, the studied doses of gamma radiation had a decreasing effect on number of leaves and plant height.

El-Bayoumi (1985) exposed the dry seeds of four soybean cultivars to gamma rays ranged from 5 to 40 Kr. and found that plant height trait was significantly decreased as doses increased .While there was no significant effects for radiation on number of branches per plant.

Cameiro *et al*. (1989) subjected the seeds of two varieties of common bean to 0,4,8,12,16 and 20 kr doses of gamma-rays. They revealed that the increasing of doses caused decreasing of plant height.