

**EFFECT OF DIFFERENT METHODS OF VEGETATIVE
PROPAGATION ON YIELD AND QUALITY OF
POTATO UNDER SANDY SOIL CONDITIONS**

By
GEBREEL ABD ALLAH MOHAMED ABD
ALLAH

B.Sc. Agric. (Horticulture), Ain Shams Univ,1992

A thesis submitted in partial fulfillment
of
the requirements for the degree of
MASTER OF SCIENCE
in
Agricultural Science
(Vegetable Crops)

Department of Horticulture
Faculty of Agriculture
Ain Shams University

2000

APPROVAL SHEET

EFFECT OF DIFFERENT METHODS OF VEGETATIVE PROPAGATION ON YIELD AND QUALITY OF POTATO UNDER SANDY SOIL CONDITIONS

By
GEBREEL ABD ALLAH MOHAMED ABD
ALLAH

B.Sc. Agric,(Horticulture) Ain Shams Univ,1992

This Thesis For M.Sc. Degree has been approved by :

Prof. Dr. Ahmed Hassan Khoriba.....

Prof. of Vegetable Crops , Fac. Agric. , Cairo University.

Prof. Dr.Refaat Mohamed Helal.....

Prof. of Vegetable Crops , Fac. Agric. , Ain Shams University.

Dr. Mohamed Emam Ragab(supervisor).....

Associate Prof. of Vegetable Crops, Fac. Agric. ,Ain Shams
University.

Date of examination: / /2000

**EFFECT OF DIFFERENT METHODS OF VEGETATIVE
PROPAGATION ON YIELD AND QUALITY OF
POTATO UNDER SANDY SOIL CONDITIONS**

By
GEBREEL ABD ALLAH MOHAMED ABD
ALLAH

B.Sc. Agric. (Horticulture) ,Ain Shams Univ,1992

Under supervise of
Prof. Dr. Ibrahim Ibrahim El- Oksh
Prof. of Vegetable Crops , Fac. Agric. , Ain Shams University.

Dr. Mohamed Emam Ragab
Associate Prof. of Vegetable Crops, Fac. Agric. ,Ain Shams
University.

Dr. Islah Mohamed Mohamed El-Hifny
Researcher of Vegetable Crops , Vegetable Unit, Plant Production
Department , Desert Res. Center

ABSTRACT

Gebreel Abd Allah Mohamed Abd Allah . Effect of different methods of vegetative propagation on Yield and quality of potato under sandy soil conditions . Unpublished Master of Science , Thesis . Department of Horticulture, Faculty of Agriculture, Ain Shams University.

A field experiment was carried out at Abd El-mageed Seleem Village , El Nobariah Sector , El Behera Governorate during the summer seasons of 1997 & 1998 . The planting dates were Jan. 15th and 20th for both seasons , respectively. Treatments were arranged in split plot design . Cultivars (Nicola and Diamant) were presented in the main plots and the propagation methods (large tubers , small tubers , vertical pieces, apical pieces , attachment pieces and mini tubers) were presented in the split plots with four replicates . In general , obtained results indicate that large tubers surpassed the other methods in emergence , plant height , fresh and dry weight , stem and branches number per plant .

Also large tubers showed superiority in average plant yield , total yield (ton / fed.) , tuber dry matter and specific gravity . While large tubers , apical and attachment pieces showed significant increase than small and mini tubers in tuber >50mm percentage . In addition , large tubers gave the highest content for total carbohydrates , total sugars and reducing sugars.

Nicola cultivar showed significant increase in average plant yield and total yield , while adverse results

were obtained for total carbohydrates . Also interaction between cultivars and propagation methods had

significant effect on plant height , plant fresh weight , branch number / plant , average plant yield , and total yield

Key words:

Potato cultivars - Vegetative propagation materials - Quality - Yield - Carbohydrates .

ACKNOWLEDGMENT

I would like to express my sincere thanks and appreciation to **Dr. IBRAHIM I. EL-OKSH** , Professor of Vegetable Crops , Faculty of Agriculture , Ain Shams University for suggesting the current study , faithful attitude and valuable scientific supervision .

I am also indebted to **Dr. Mohamed E. Ragab** , Associate Professor of Vegetable Crops , Faculty of Agriculture , Ain Shams University for his supervision ,valuable advice and faithful efforts during the course of this investigation .

Grateful thanks are due to **Dr. Islah M. El -Hifny** , Researcher of Vegetable Crops , Vegetable Unit , Plant Production Department , Desert Research Center for her valuable advice, guidance and fruitful suggestions during the work of this investigation .

Thanks are also passed to the all staff members of Vegetable Unit , Plant Production Department , Desert Research Center for their co-operation .

CONTENTS

Page No.

1.	INTRODUCTION.....	1
2.	REVIEW OF LITERATURE.....	3
2.1	Growth characteristics.....	3
2.2	Yield characteristics.....	8
2.3	Chemical component.....	13
3.	MATERIALS AND METHODS.....	16
4.	RESULTS AND DISCUSSION.....	21
4.1	Growth characteristics.....	21
4.1.1	Emergence percentage.....	21
4.1.2	Plant height.....	21
4.1.3	Plant fresh weight and dry matter %.....	23
4.1.4	Stem number \ plant.....	25
4.1.5	Branches number \ plant.....	25
4.1.6	Number of leaves per plant.....	27
4.1.7	Leaf area (cm ²).....	27
4.2	Yield characteristics	29
4.2.1	Plant average	29
4.2.2	yield.....	32
4.2.3	Number of tuber per plant.....	34
4.2.4	Average tuber weight.....	34
4.2.5	Total yield	37
4.2.6	Large tuber percent.....	40
4.2.7	Dry matter percent.....	40
	Specific gravity.....	
4.3	Chemical component.....	40
4.3.1	Total carbohydrate	40
4.3.2	Total sugars content	43
4.3.3		43
	Reducing sugars	
5.	SUMMARY AND CONCLUSION.....	44

6.	REFERENCES.....	46
7.	ARABIC SUMMARY.....	

LIST OF TABLES

Table No.		page No.
(A)	Seed weight , eye number / piece and seed requirement (ton/fed.).....	17
(B	Soil chemical and mechanical analyses.....	18
)		
(1)	Effect of different vegetative planting materials of potato on plant fresh weight and dry matter (Combined analysis of 1997&1998 seasons).....	22
(2)	Effect of different vegetative planting materials of potato on stem and branch number/plant (Combined analysis of 1997&1998 seasons).....	24
(3)	Effect of different vegetative planting materials of potato on leaves number/plant and leaf area (Combined analysis of 1997&1998 seasons)	26
(4)	Effect of different vegetative planting materials of potato on tuber dry matter percent and specific gravity (Combined analysis of 1997&1998 seasons).....	28
(5)	Effect of different vegetative planting materials of potato on plant yield, tuber number/plant and average tuber weight (Combined analysis of 1997&1998 seasons)	30
(6)	Effect of different vegetative planting materials of potato on plot yield and total yield (ton/fed) (Combined analysis of 1997&1998 seasons)....	35
(7)	Effect of different vegetative planting materials of potato on percentage of tubers >50 mm. as number and as weight (Combined analysis of 1997&1998 seasons)	38

(8) Effect of different vegetative planting materials of potato on plant fresh weight and dry matter (Combined analysis of 1997&1998 seasons).....	41
(9) Effect of different vegetative planting materials of potato on total carbohydrates , total sugars and reducing sugars(g./100g.dry matter) (Combined analysis of 1997&1998 seasons).....	42

LIST OF FIGURES

Fig. No.	Pag No.
1. Effect of different vegetative planting materials on plant yield and average tuber weight (g)	31
2. Effect of different vegetative planting materials on stem and tuber number/plant	33
3 Effect of different vegetative planting materials on total yield (ton/fed).....	36
4 Effect of different vegetative planting materials on percentage of tubers >50mm. diameter.....	39

1.INTRODUCTION

Potato(*Solanum tuberosum*) is considered as one of the most economical and important vegetable crops in Egypt . Total area planted with potato was 62244 fed. in the winter season of 1998/99 with an average yield of 10.1 ton/fed. , 73473 fed. in the autumn season with an average yield of 8.3 ton/fed. and 71813 fed. in the summer season with an average yield of 10.3 ton/fed. *

The yield of this area is used for the local market , processed or exported to different countries .

There are different plant materials used in potato planting *E.g.* imported , local produced seed, tissue culture products .

Growers cultivate autumn season with local produced seeds but its yield is not valid to be used as seed source because in this time the virus translators such as white fly and other insects are active . Winter season is normally cultivated with local produced seeds but its yield is harvested after the summer season cultivation date. The summer season is cultivated with imported seeds or local produced seeds but the local one is old in its physiological age because of its long storage period from the previous season .

Imported seeds are almost expensive as compared with the local seeds. In a wide area the growers cut the tubers into seed pieces to minimize the cost . On the other hand, they cultivate the local seeds without cutting .

* Department of Agricultural Economics & Statistics.
Ministry of Agriculture and Land Reclamation , A. R.
Egypt .

Several factors affect potato yield such as seed weight ,seed source and eyes number per tuber .Also cutting the seeds affects the yield and its quality through the infection possibility from soil and it may deteriorate at the high temperature and high soil moisture so it may give low stand percentage .

Tissue culture methods produce high quality seeds because this seed is virus free ,but in Egypt, tissue culture products are still insufficient to be an alternative seed source beside it is expensive but in the future the cost may be low.

Generally,in Egypt there is a wide desert surrounding the old valley so that the future of the egyptian potato production will be in this desert .

Developing the desert is the main aim in Desert Research Center so this trial was carried out in the sandy soil conditions to study the effect of different vegetative planting materialson potato yield and quality under sandy soil conditions .

2.REVIEW OF LITERATURE

2.1. Growth characteristics

2.1.1.Emergence percentage.

The physiological age of potato tuber seed affects emergence via its effect on seed sprouting .Wiersema

(1985) concluded that physiological age affects plant emergence , stem number , tuberization , vegetative growth , maturation and yield .Moreover , the previous characters decrease at the old physiological age . El-Gizawy *et al.*(1987) reported that emergence of local produced potato tuber seeds sprouted for 2 or 4 weeks were faster than that of imported seed tubers . Abd El-Hak *et al.* (1990) reported that final plant stand was not affected by potato cultivar but it was significantly greater by using large size of seed tubers . Seedling tuber derived from true potato seed ranging in weight from 0.5 to 35 g showed that the emergence was generally faster with large tubers than with small ones , but the final emergence was about 90% regardless of seedling tuber weight (Engels *et al.*1993a). On the other hand , emergence after 30 day was higher from entire seed tubers than seed tuber pieces as recorded by Coraspe and Cartaya (1994) . Lommen and Striuk (1994) stated that the heavier mini tuber gave more regular emergence . In addition, Lommen and Striuk (1995) stated that lighter tubers took longer period to produce sprouts of 2 mm. Moreover, the sprouts grew more slowly between 2 and 4 mm. The influence of tuber weight was non significant for heavier tubers and also decreased as the sprout grew longer. Vecchio *et al.* (1996) concluded that 100% emergence achieved by 40 days after planting with mini tubers >15 mm diameter . As for cultivar , Alba emergence was the most quickly as compared with Spunta cv.

2.1.2. Plant fresh and dry weight .

El - Beheidi *et al.* (1975) cleared that growth of plants , expressed as foliage fresh weight , varied according to potato cultivars whereas Grata and Desire

showed more vigorous growth followed by Alpha .On the contrary , Wilga and Seniada had poor foliage weight . Abd El-Hak *et al.*(1990) reported that seed size significantly affected the plant vigour, also cultivars significantly affected the plant vigour . Spunta and Korrigan showed significant increment as compared to variety Lola.

Byszewska *et al.*(1993) concluded that potatoes cv. Lotos and Foka were grown from elite seed tubers (3 - 4 cm) or mini tubers (1 - 2 cm) planted at a rate of 80 000 or 160 000 plants/ ha. After 75 days from planting, fresh weight from mini tubers was 422 -461 g. and that from traditional seed tubers was 439 - 608 g El-Nashar *et al.* (1995) mentioned that large seed size of 4.5-6.0 cm gave the highest significant foliage weight at harvesting time and small size of 2.5 - 3.5 cm gave the lowest values while medium seed size of 3.4 - 4.5 cm was in between , the same outhier showed that cultivars had significant effect on foliage weight . The highest foliage weight was obtained by Spunta followed by Mondial , while the lowest foliage weight was obtained by Diamant and Baraka.

Rabie(1996) concluded that significant differences were observed among cultivars in plant fresh and dry weigh .

2.1.3. Plant height .

Mahmoud and Gill (1984) reported, in their study on Disiree , Wilja , Multa and Diamant cultivars and three tuber weights (25 , 50 and 75 g.) ,that Disiree tubers weighing 75 g had the favorable effect on plant height .

El- Gizawy *et al.* (1987) reported that plant height at 50 , 70 and 90 days after planting was not affected significantly with whole tuber or cut seed tuber . Ibrahim *et al.* (1990) cleared that significant differences in plant height were shown among Ajax , Alpha and Nicola potato cultivars . In addition , El Nashar *et al.* (1995) cleared that tuber size had significant effect on plant height . It was the highest with planting of large seed tubers size , while small tubers size caused a dwarfing effect on stem length . Also ,stem length was significantly affected by cultivars whereas Spunta had the highest plant length in all seasons followed by Diamant in the first and third seasons and Baraka in the second season , the shortest plant was obtained with Mondial in all seasons. Rabie(1996) reported that significant differences were observed among potato cultivars in stem length . In a study carried out to assess the performance of Alba cv. potato mini tubers were compared with conventional seed tubers of potatoes cv.Spunta , Vecchio *et al.* (1996) mentioned that plant height reduced with tubers < 15 mm and there were significant difference between the tested cultivars .

2.1.5. Number of stems and branches.

El - Baz *et al* (1980) , Abd El-Hak *et al* (1990 and 1991) and Ibrahim *et al* (1990) studied the difference in number of main stems , they found that the number of main stems differed significantly among potato cultivars . Entz and Lacroix (1984) found that the main stems per plant were influenced by seed tuber piece weight, while number of axillary branches was increased by decreasing competition . Hassan (1991) reported that sprouting of seed tubers was affected by apical dominance . Most of potato