Bulletin UASVM Horticulture, 69(1)/2012
Print ISSN 1843-5254; Electronic ISSN 1843-5394

The Influence of the Conditions of Growth on the Morphological Traits of Dill Plants

Tatiana NOVAC[1)]

[1)]State Agrarian University of Moldova, Faculty of Horticulture,
Vegetable Department; t.novac82@gmail.com

Abstract. The investigations were conducted in the years 2009-2011in the condition of field experiment located at the Department of vegetable production, State Agrarian University of Moldova. The biological material used in experience is represented by variety of dill: Gribovskii early variety, created in Russia, approved and included in the register of plant varieties. This cultivar is intended for use in fresh and for technical purposes. The investigated three types of land protected: plastic greenhouses, low tunnel, non woven fleece Agryl and control plots without cover. The experiment was started in the 02 April 2009, 31 March 2010 and 28 March 2011 on the $3m^2$ fields designed by the randomized method in three replicants. The aim of present investigation was to give an overview about the effect of the types of land protected on increased early yield, germination, development and growth speed, plant height, number and area of leaves of plants and protects against low temperature.

Keywords: Dill, germination, height, leaves, petioles, weight of plant

INTRODUCTION

Anethum graveolens L. is commonly known as (dill), native to Mediterranean and South Eastern Europe countries (Dubrovin, 2000; Girenko and Zvereva, 2007; Nistor *et al*., 2003).

Dill (*Anethum graveolens* L.), a biennial or annual herb of the parsley family (*Apiaceae* or *Umbelliferae*), is native to southwest Asia or southeast Europe and cultivated since ancient times (Bailer *et al*., 2001; Pantielev, 1979).

The leafy tops can be clipped and used in cottage cheese, potato salad, cream cheese, tomato soup and salads (Dambrauskene *et al*., 2007; Nistor *et al*., 2003).

Dill (leaves, fruits) have several uses in medicine as antispasmodic, sedative, aromatic stimulant and for the treatment of flatulent colic (Ciunel, 1999; Dambrauskene *et al*., 2007, Merzlyakov, 2009).

They are also used as diuretic, in renal colic, high cough in bronchial asthma, vomiting, neuralgia, genital ulcer and dysmenorrheal (Ciunel, 1999; Dubrovin, 2000). Currently it is used in the food industry and cosmetology (Girenco and Zvereva, 2007).

The way in which vegetable crops can be protected to promote growth and improve the growing period can vary between simple and inexpensive methods to complicated capital intensive ones. There are several types of constructions and accompanying covering materials: constructions that are covering with plastic film and screening materials (Conovali and Fala, 2008; Patron, 1992).

Protected cultivation of vegetables is used to modify a plants natural environment in order to optimize growth, to protect plants from insects, cold and wind, protecting from frost thus extends the growing season of a crop. By using constructions and covering materials as

plant cover generally results in early crop production, which gives higher crop prices at market (Conovali and Fala, 2008)

Also other authors confirmed favorable influence of covering by polypropylene fleece on yield and early harvest of lettuce, carrot, radish, spinach and potatoes (Dvořak *et. al*., 2004; Reghin *et al*., 2002a; Sodkowski and Rekowska, 2004b).

Rekowska and Skupien (2007) demonstrated that covering with non-woven polypropylene was found to increase the yield of spring garlic in comparison to open field cultivation.

Broccoli heads grown under polypropylene non-woven fabric Agryl P-17 were significantly heavier than those from control plants (Kunicki *et al*., 1996).

The highest yield was obtained, when dill plants were grown under polypropylene film (Slodkowski *et al*., 1999).

Favorable economical results for the high tunnel, low tunnel, glasshouse use for early production of dill were ascertained (Ciunel, 1999; Conovali and Fala, 2008; Dubrovin, 2000).

MATERIAL AND METHODS

The investigations were conducted in the years 2009-2011. The experiences have been located in the experimental teaching of field-vegetable production Department of the State Agrarian University of Moldova.

The geographical location of the place where took place the experiences, corresponding to the coordinates: 47°20′ North latitude and 28°50′ East longitude. Climate is temperate continental.

The soil is loamy carbonate chernozem, pH 7.35-7.90, humus content in the upper layers of soil reaches 2.91- 3.91%-and gradually shrinks in the lower layers. It is necessary to note that the soil has a low content of organic substances.

The biological material used in experience is represented by variety of dill: Gribovskii early variety, created in Russia, approved and included in the register of plant varieties. The dill was growing for green mass in covering space and construction: high tunnel, low tunnel, non woven fleece Agryl, control plots without cover.

High tunnel - are simple, tall, plastic-covered structures, for the production of fruits and vegetables, cut flowers, and many other high-value alternative crops. The structure consists of galvanized tubing. The intervals between the support hoops are 2 m. This type of greenhouse is mainly found in our country. The plastic film covering is usually of a simple PE quality and must be replaced after 1-2 years.

Low tunnels - are actually miniature greenhouses variety of types has been developed comprising of a semi cylindrical supporting framework covered with plastic film. The hoops need to be placed at intervals of about 1 or 1.5 m apart and anchored in the ground. After stretching the plastic film (for instance, polythene or PVC) over the hoops, the sides can be weighted down with a layer of soil. For ventilation, the plastic film can be lifted up or shifted a little (Conovali and Fala, 2008; Patron, 1992).

Agryl - a protective crop cover also known as floating row cover. Agryl can be placed on fields to enhance early yields and minimize crops from frost damage, insects or wind damage. Agryl is made using a single pass technique which arranges the polypropylene fibres in a random fashion. With proper care Agryl can be reused for several years.

The experiment was established in mono factorial design with three replications and plot area 3 m^2. The seeds of dill were sown in the 02 April 2009, 31 March 2010 and 28 March 2011. The dill was sown in rows 20 cm apart, the seeds being placed in seeding belts about 1.5 cm in width. During the period of vegetation were determined phenological and

biometric measurements (Byelik, 1992). The measurements included plant height, plant weight and the number of leaves per plant. The harvest of dill was conducted when the plant reached 25 cm in height. After harvest the total production were determined. The results of the experiment were analyzed by standard statistical procedure (Moisejčenko *et al*., 1994).

RESULTS AND DISCUSSIONS

Germination of dill seeds is influenced by a wide range of factors, very important are: quality of seeds, climate conditions, land preparation, etc., these factors influence the uniformity and the percentage of plants after emergence.

Tab. 1

Emergence of dill depending on the type of land protected, days

Variants	Number of days from sowing to emerging			
	2009	2010	2011	Mean
V_1 - Plots without cover (C)	13	15	16	14.6
V_2 - Agryl	11	13	13	12.3
V_3 - Low tunnel	10	10	12	10.6
V_4 - High tunnel	9	9	8	8.7

Duration of the emergence plants from four variants varied of the non-uniform quite depending on the method of protecting culture, being the period between 9-13 days in 2009, 9-15 days in 2010 and 8-16 days in 2011.

A smaller number of days from sowing to emerging compared with the variant 1 - Plots without cover was recorded at the variant 4 - high tunnel, good results were achieved also on the type of protection low tunnel and agryl.

Favorable influence these types of protected was connected with artificially created microclimate conditions, which advanced sprouting by four up to six days compared to control and accelerated further growth and crops development when weather conditions were less favorable for dill.

Knowledge of the number of days from sowing to emergence for dill is required with the view that this species is characterized by the germination of seeds in a long-term due to the presence in the seeds etheric oils, that do not allow water penetration to the embryo and thus discourage conditions conducive to germination of most culture dill can be compromised.

Thus by creating better conditions for germination of seed germination of accelerated the dill, which contributes to the production of earlier green mass.

Tab. 2

Mean biometric indexes of dill depending on the types of land protected, 2009-2011

Variants	Mean height of plant, cm	Mean height of above ground part of plant, cm	Mean height of root, cm	Number of leaves per plant
V_1 (C)	19.89	12.14	7.75	3.42
V_2	23.61	13.91	9.70	4.03
V_3	26.80	15.42	11.37	4.04
V_4	30.15	19.20	10.94	4.56
$DL_{0.95}$	4.09	2.83	-	0.71

The highest values of biometric indices were recorded at V_4 with significant difference compared to the other variants considered in the study. A larger number of leaves per plant was highlighted in high tunnel (V_4) with a difference compared to noncovered plant - V_1 (C) by 0.95. This development can be explained partly by the fact that the conditions for growth in high tunnel were more favorable, but also because the process of emergence in greenhouse was in a smaller number of days compared with the plots without cover (C).

In average years of experience, $DL_{0.95}$ - constituted 2.83 cm for mean height of above ground part of plant and there are significant and essential difference between control and variant 4 (7.60 cm). Coefficient of variation - 11.45.

$DL_{0.95}$ for the number of leaves/plant in the average years of experience was 0.71, there is significant and essential difference between the control and variant 4 (1.14). Coefficient of variation - 10.93.

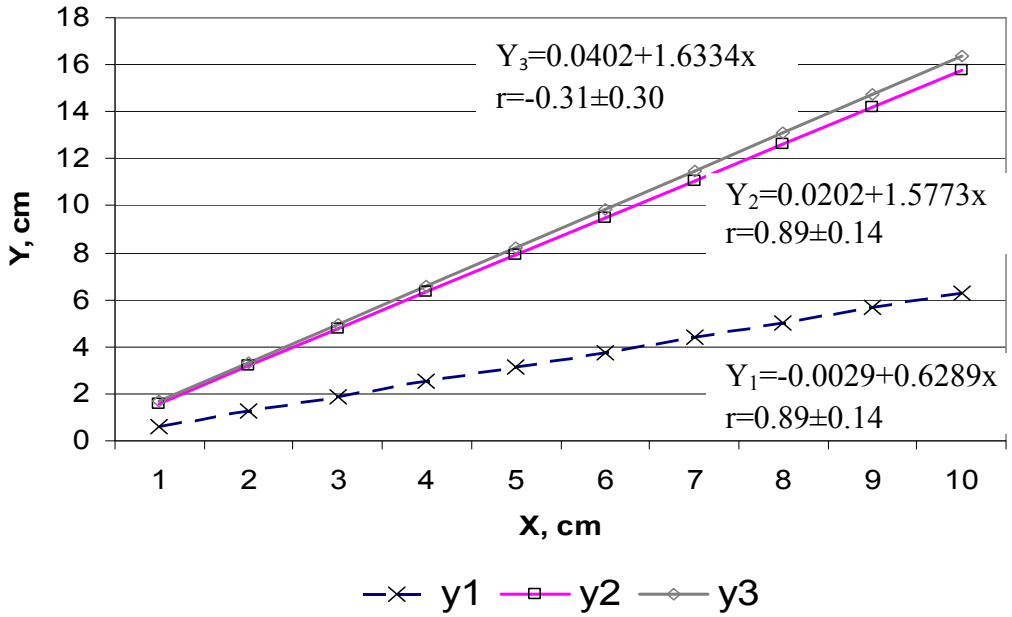

Fig. 1. Expression of linear regression equations Y_1, Y_2 and Y_3

As a result of the analysis of correlation and regression was determined the coefficient of correlation between the total height of plant and the height of above ground part of plant, which was r = 0.89 ± 0.14, which demonstrates the strong positive relationship (r > 0.70) between these indices. Coefficient of determination being d_{yx} = 0.79, in our case the height of above ground part of plant is influenced at 79% of the total height of plant, the other party is determined by other factors increased 21%. Also the linear regression equation - Y_1 = 0.0029 + 0.6289x so, increasing the total height of plant with 1 cm, height of above ground part of plant increases with 0.63 cm (Fig. 1).

Linear regression equation was given the form Y_2 = + 1.5773x 0.0202, so increasing the height of above ground part of plant with 1 cm, it increases the total height of the plant with the 1.57 cm (Fig. 1).

The coefficient of correlation between the height of above ground part of plant and height of the root, which was r = -0.31 ± 0.30, which shows the average negative (-0.7 < r <-0.3) between these indices. The coefficient of determination was d_{yx} = 0.1 if the height of above ground part of plant is influenced at the height of root of 10%, the other party is determined by other factors in the amount of 90%. Linear regression equation was given form

Y_3 = 0.0402 +1.6334x, so increasing the height of root 1 cm, the height of above ground part of plant increases with 1.63 cm (Fig. 1).

Plant growth is a complex process characterized by various quantitative changes of plant tissue from meristematic activity.

Tab. 3

Morfological traits of plants depending of the types of protected, 2009-2011

Variants	Mean weight of plant, g	Mean weight of above ground part of plant, g			Weight of root, g
		total	inclusive:		
			petioles	the leaf blade	
V_1 (C)	1.08	0.95	0.44	0.51	0.11
V_2	1.52	1.34	0.60	0.74	0.18
V_3	1.71	1.48	0.72	0.76	0.23
V_4	2.04	1.77	0.88	0.89	0.27
$DL_{0.95}$	0.47	0.44	-	0.21	-

Intensive plants depend to some extent on the genetic characters of the species and variety, but an important role in this process and the environmental factors that are properly routed in favor of culture affects technology to speed up plant growth and increase harvests.

$DL_{0.95}$ in average years of experience for total weight of plant was 0.47 g, there is significant and essential difference between the control and variants: variant 3 (0.63); 4 (0.96 g).

$DL_{0.95}$ for the weight above ground part of plant plants constituted 0.44 g, there is significant and essential difference between the control variant and variant 4 (0.82 g).

In average years of experience for weight of leaves $DL_{0.95}$ constituted (0.21g), there is significant difference between the control and variant 4 (0.40 g).

As a result of the analysis of correlation and regression was determined the correlation coefficient between the weight of the leaf blade and the total weight of plant, which was r = 0.98 ± 0.06, indicating a strong positive relationship (r > 0.70) between these factors. Coefficient of determination d_{yx} = 0.96, that is, in our case the weight of leaves is influenced by the 96% of the total weight of the plant, the other party is determined by other factors in the amount of 4%. Also the linear regression equation Y_4 = 0.0027 + 0.4634x, that is, to increase the total weight of the plant with 1 g, increases the weight of the leaf blade with 0.46 g (Fig. 2).

Determining the correlation coefficient between the weight of leaves and the total weight above ground part of plant, it was obtained r = 0.98 ± 0.06, indicating a strong positive relationship (r > 0.70) between these factors. Coefficient of determination d_{yx} = 0.96 being, that is, in our case the weight of the leaf blade is influenced by the 96% of the total weight of the plant, the other party is determined by other factors in the amount of 4%, according to the same rule as in the case of the total weight of the plants. Also the linear regression equation Y_5 =0.0065+0.5456x, that is to increase the total weight above ground part of plant with 1 g, increases the weight of the leaf blade with 0.55 g (Fig. 2).

The coefficient of correlation between the weight of the leaf blade and weight of the petioles was r = 0.90 ± 0.14, which demonstrates the strong positive relationship (r > 0.70) between these factors. Coefficient of determination d_{yx} = 0.81, being thus the weight of the leaf blade is influenced by 81% by weight of petioles, the other side is determined by other factors 19%. Linear regression equation was given the form of Y_6 = 0.476 + 0.7566x, so to increase the weight of petioles with 1 g, increases weight of leaf blade with 0.76 g (Fig. 2).

As a result of the analysis of correlation and regression was determined the coefficient of correlation between the weight of the leaf blade and the weight of the root of the plant, which was r = 0.88 ± 0.15, which demonstrates the strong positive relationship (r > 0.70) between these factors. Coefficient of determination being d_{yx} = 0.77, so in our case the weight of the blade leaf is influenced by 77% by weight of roots of the plant, the other party is determined by other factors increased 23%. Also the linear regression equation - Y_7 = 0.0115 + 3.0052x, so to enhance root mass with 1 g, increases the weight of the leaf blade with 3 g (Fig. 2).

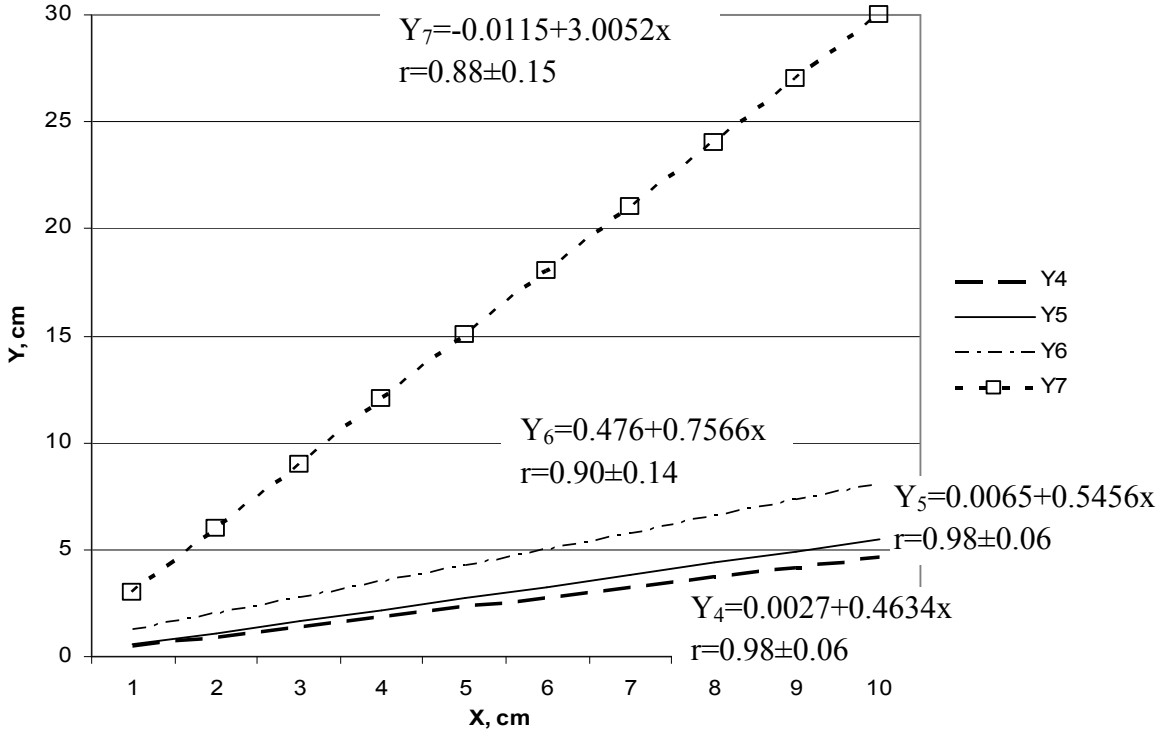

Fig. 2. Expression of linear regression equations Y_4, Y_5 Y_6 and Y_7.

CONCLUSIONS

Duration of the emergence plants depending of the conditions of growth and types of protected. Dill grown under Agryl, low tunnel and high tunnel germinate faster so these types of protected was connected with artificially created microclimate conditions, which advanced sprouting by four up to six days compared to control.

Dill grown under Agryl, low tunnel and high tunnel had greater leaf area, increased number of leaves per plant and increased plant height compared with non-covered plants. Dill grown under of types of protected area reach earlier maturity than plants in control.

REFERENCES

1. Bailer, J., T. Aichinger, G. Hackl, K. De Hueber and M. Dachler (2001). Essential oil content and composition in commercially available dill cultivars in comparison to caraway. Industrial Crops and Products. Int. J. 14:229-239.

2. Byelik, V.F. (1992). Technique of experimental work in vegetable and melon growing. Ed. Agropromizdat. Moscow. 312.

3. Conovali, V. and A. Fala (2008). Business in the vegetables in protected land. Chisinau. 120.

4. Ciunel, M.M. (1999). Dill Cultivation in protected and open field. Gavrish. 6:6-10.

5. Dambrauskene, E.L., M. Rubinskene and P.I. Viškelis (2007). Yield of dill depending of cultivars. Potatoes and vegetables. 7:11.

6. Dubrovin, I., (2000). All about dill. Ed. Eksmo - Press, Yauza. 36

7. Dvořak, P., K. Humorr, J. Čepl and J. Pivec (2004). The non-woven fleece as an implement for acceleration of early potatoes harvest. Sci. Agr. Bohemica. 35(4):127-130.

8. Girenko, M. and O. Zvereva (2007). Spicy taste vegetables. Ed. Niola-press. Moscow. 255.

9. Kunicki, E., S. Cebula, A. Libik and P. Siwek (1996). The influence of row cover on the development and yield of broccoli in spring production. Acta Hort. 407:377-384.

10. Merzlyakov, L. (2009). Agrobiological justification and characteristics of cultivation of greens cultures in northern Trans-Ural. Synopsis of the dissertation on competition of getting a degree of doctor in agricultural sciences, 34.

11. Moisejčenko, F., A.K. Zaveryukha and M.F. Trifonova (1994). Fundamentals of scientific research in plodovodstve, vegetables and viticulture. Kolos, 383.

12. Nistor, S., N. Munteanu and T. Stan (2003). Vegetable production. 3:315 .

13. Pantielev, J.H. (1979). Green culture. Ed. Rossel′hozizdat. Moscow. 55.

14. Patron, P. (1992). Vegetable growing. Ed. Universitas. Chisinau. 468.

15. Reghin, M., R. Otto, J. Vinne and A. Feltrin (2002a). Yield of pack choi crop under non woven polypropylene. Hort. Brasilera. 20(2):233-236.

16. Rekowska, E. and K. Skupien (2007). Influence of flat covers and sowing density on yield and chemical composition of garlic cultivated for bundle-harvest. Vegetable crops research bulletin. 66:17-24.

17. Slodkowski, P., M. Orlowski and E. Rekowska (1999). Effect of using covers at dill cultivation on the quality and quantity of its yield. Zeszyty Problemowe Postepow Nauk Rolniczych. 466:165-171.

18. Sodkowski, P. and E. Rekowska (2004b). The influence of flat covers on yielding of some vegetable species grown for early harvest. Agricultura. 93:355-359.