Заключение

Таким образом, предложенная конструкция спирально-шнекового высевающего аппарата позволяет повысить равномерность высева минеральных удобрений путем интенсификации обрушения сводов сыпучих материалов в бункерах.

Список использованной литературы

1. Коробской, С.А. Совершенствование технологического процесса внесения минеральных удобрений спирально-шнековым аппаратом: автореферат дис. ... канд. техн. наук: 05.20.01 / С.А. Коробской, ФГО УВПО «Азово-Черноморская государственная агроинженерная академия». – Зерноград, 2005. – 18с.

2. Патент на изобретение РФ 2233064 С1, МПК А 01С 15/08, 15/00, 2004.

3. Спирально-шнековый высевающий аппарат: патент 12842 С1 Респ. Беларусь, МПК А 01С 15/00 / И.Н. Шило, В.А. Агейчик, Ю.В. Агейчик; заявитель Белорус. гос. аграр. техн. ун-т. – № а 20071112; заявл. 13.09.2007; опубл. 28.02.2010 // Афіцыйны бюл. / Нац. цэнтр інтэлектуал. уласнасці. – 2010. – №1.

UDK 631.531.12

EXPERIMENTAL STUDIES ON EFFECT OF FIBER SIZE IN PEAT SUBSTRATE ON TRAY SEEDING DEPTH (ЭКСПЕРИМЕНТАЛЬНЫЕ ИССЛЕДОВАНИЯ ПО ВЛИЯНИЮ РАЗМЕРА ВОЛОКОН ТОРФЯНЫХ СУБСТРАТОВ НА ГЛУБИНУ ЗАДЕЛКИ СЕМЯН В КАССЕТЫ)

Muhammad Bello Garba, PhD, Chief Lecturer, Director

Centre for Entrepreneurship Development and Innovation
Shehu Shagari College of Education, P.M.B. 2129, Sokoto,
Sokoto State – Nigeria

Аннотация. Приведены результаты исследований по определению размера волокон торфяного субстрата для кассетной технологии, применяемого при высеве семян овощных культур. По результатам исследований доказаны, что применяемый торфяной субстрат «Двина» для выращивания овощной рассады не соответствует агротехническим требованиям кассетной технологии и установлено, что для заполнения ячеек кассеты торфяным субстратом, длина волокон используемого субстрата должна составлять не более 1/3 диаметра ячеек кассеты.

Abstract. The results of studies on determining the size of peat substrate fibers for tray technology used for sowing vegetable seeds are presented. According to the research results, it was proved that the peat substrate “Dvina” used for

growing vegetable seedlings does not meet the agrotechnical requirements of the tray technology, and it was found that to fill the tray cells with peat substrate, the length of the fibers to be used substrate should be not more than 1/3 of the tray cell diameter.

Ключевые слова: агротребования, кассетная технология, овощные культуры, рассада, торфяной субстрат, волокна

Keywords: agricultural requirements, tray technology, vegetable crops, seedlings, peat substrate, fibre.

Introduction

Most vegetables are established from transplants grown in trays using growing media [5]. Advantages of growing media especially peat substrates in tray seedlings production depend on their favourable physical characteristics; which include low bulk density, a high porosity and a high nutrient exchange capacity, providing an optimal raw material in which the desired nutrient contents and pH can easily be adjusted. Therefore, peat substrates provide an ideal environment for seedling propagation and growth [6] and [7] and as such are now globally used in greenhouse seedling production.

Peat is a main component of most soilless media mixes used in tray seeding today which consists of mixtures of components that provide water, air, nutrients and support to plants [8], [9], and [10]. All media provide plant support, while the nutrients are provided by added fertilizers. Peat substrate used as growing media in tray seedling production has different fibre size and fine milled peat has a smaller fibre size. Media settling may result in loss of plant-rooting volume [11].

Seed may be sown directly into cells of a seedling tray manually or an alternate method is to be sown by automatic cell tray seeder and then transplant the young seedlings to the field when the first true leaves are evident.

According to Muhammad [12], seeding in trays, seeds are placed at the required spacing and provide a better growing area per seed before transplanting. The following are some of the advantages of cell/plug tray technology:

- Faster and more accurate sowing which saves time, labour and seeds;
- Little or no transplanting shock to young plants because the roots are not disturbed;
- Less spread of disease;
- Saves overall space and allows for extra crops in the same unit area;
- Uniform transplants, and transplanting can be mechanized;
- Increased productivity and yield quality;
- Full preservation of the root system during transplanting;
- Acceleration of ripening period by 15-20 days.

Seeding depth is one of the most important factors which influence on the seed germination [1] and [2]. Deep seed sowing has a number of effects on seedling emergence, growth and development. For instance, there may be an increase in the time between seed germination and seedling emergence as found by [3], which largely determines the ranking of seedlings in the competitive hierarchy for growth resources [4]. Variably, very shallow seeding in trays can lead to a high seed rate and incidence of seedling loss.

The objectives of this study were to investigate the influence of fiber size of peat substrate on shape and depth of the formed indents (holes) in the cell tray for seeding vegetable seeds on vacuum seeder with drum type metering device.

Materials and Methods

The study was carried out indoor in soil bin laboratory of the Department of Agricultural Machinery, Belarusian State Agrarian Technical University, (53^0 54^0 N latitude, 27^0 34’ E longitudes and an altitude of 281 m above mean sea level), Minsk in 2016.

The source material used for studying the investigate the influence of fiber size of a peat substrate on shape and depth of the formed indents (holes) in the cell tray was the widely sold peat substrate “*Dvina*” brand (TU RB 100219992.326-200). Trays are produced with 25, 64 and 144 individual cells produced by JSC "Belvtorpolimer", Grodno city, Belarus. A 64 cells plastic tray with a cell volume of 65 cm^3, a top and a bottom diameter of 45 and 38 cm respectively as well as a ruler and a compression device – PCG-F for soil testing were used to conduct the studies.

Four samples of a substrate of the same mass were selected, which were then mixed with peat fibres of the same mass, but of different lengths (5, 15, 25 and 35 mm) as in Figure 1a. The cells of the tray were filled with experimental peat substrate of the same volume.

In order to form depressions (holes) in the tray cells with equal force applied to puncheon pusher, a compression instrument PCG-F for soil testing was used to indent the peat substrate in the tray cells until a depression (hole) was formed in the center of the cell for seed placement as shown in Figure 1b.

a *b*

Figure 1 – General view of peat fibre (*a*) and cells filled with experimental substrate (*b*)

The shape of the formed depression was studied visually; the depth is measured by depth gauge caliper SHZ-I-125-0.05. The shape of the depression must have a conical shape (in the form of the punch) in the center of the cell and the depth should correspond to pre-set depth of the puncheon pusher. For each four samples the experiment was repeated at least trice. Using appropriate simple descriptive statistics, the data obtained were analyzed. Calculated values of the formed depressions (holes) and their respective depth deviations from the pre-set puncheon pusher depth were determined and recorded.

Results and Discussion

From the research, it has been established that, with equal force of the puncheon pusher to the cells filled with an experimental substrate of different lengths of peat fiber (5, 15, 25 and 35 mm) depression (holes) are formed of different depths, that is, the depth of the puncheon pusher in the substrate does not corresponded to the depth of the depression (hole) formed by it and was less than the pre-set depth as shown in the Table 1 below.

Table 1. Pre-set puncheon pusher and formed holes depths in the substrate

Fibre size in the substrate, mm	Depth, mm		Depth deviation from pre-set, mm
	of puncheon pusher (pre-set)	formed in the substrate	
5	20	19,3	-0,7
15	20	17,7	-2,3
25	20	14,0	-6,0
35	20	7,3	-12,7

Analyzing the obtained data and from Table 1, it should be noted that as the length of the substrate fiber increases at the same depth of the plunger punch, the actual depth of the formed depression decreases. This is due to the fact that compacting of the substrate by the puncheon indenter, the long fiber of plant residues (more than 1/3 of the diameter of tray cell) contained therein are densified by a punch, which affects the formation of depressions in the tray cells.

It has been established by the study that the structure of the substrate composition has a significant effect on the depth formation for seeding in cell trays. The heterogeneous structure of the fibrous part of the substrate filling the cells leads to an uneven depth of seeding between the cells (Table 1). The recommended fibre size for 64-cell trays is 13-15 mm. By analogy, this can be extended for trays with 144 cells where fibre size should be not more than 8 - 10 mm accordingly.

Conclusion

According to the results obtained, it can be concluded that to ensure a given depth of seeding in tray cells it is necessary to fill trays with peat substrate containing plant residues fiber size of not more than 1/3 of the upper diameter of the tray cells. Thus, fulfillment of this requirement will allow seeding in the tray cells to a given depth in acceptable to agrotechnical limits (with a deviation of not more than 15%), which also gives uniform amicable seed shoots.

References

1. Ahirwar R. K. 2015. Effect of Sowing Depth on Seed germination of *Butea frondosa* (Roxb.). Int. Res. J. Biological Sci., 4 (2): 45–47.

2. Mertia R.S., Sinha N.K., Santra P., Singh D. 2012. Influence of seed size and sowing depth on emergence and growth performance of *Salvadora oleoides* in the Indian Thar Desert, *Indian Forester*, 138(7): 646–651.

3. Li T.S. 1997. Effect of seeding depth and of soil texture on seedling emergence and root shape of American ginseng. Korean J Ginseng Sci., 21: 115–118.

4. Ross MA, Harper JL. 1972. Occupation of biological space during seedling establishment. J Ecol, 60: 77–88.

5. Nair A., Ngouajio M., Biernbaum J. 2011. Alfalfa-based organic amendment in peat-compost growing medium for organic tomato transplant production. *HortScience,* 46: 253–259.

6. FiBL 2005. Ökologische Jung- und Zierpflanzenproduktion: Herstellung und Einsatz Komposthaltiger Pflanzsubstrate. Institut für Gemüse-und Zierpflanzenbau Greßbeeren/Erfurte e. V. Unikassel Versität (in deutch).

7. Restrepo, A. P., Medina, E., Pérez-Espinosa, A., Agulló, E., Bustamante, M. A., Mininni, C., Moral, R. 2013. Substitution of Peat in Horticultural Seedlings: Suitability of Digestate-Derived Compost from Cattle Manure and Maize Silage Codigestion. *Communications in Soil Science and Plant Analysis*, 44: 668–677.

8. Schroeder F.G., Sell H. 2009. Use of compost made from livestock manure as an organic substrate for cucumber (*Cucumis sativus* L.) grown in greenhouse // Acta Horticulturae, 819:367–372.

9. Bilderback T.E., Warren S.L., Owen Jr. J.S., Albano J.P. 2005. Healthy substrates need physicals too!. HortTechnology, 15: 747–751.

10. Hartmann H.T., Kester D.E. Davies F.T., Geneve R.L. 2002. Plant Propagation: Principles and Practices 8th Ed: Vernon Anthony et al (Eds.). Techniques of propagation by seed. Upper Saddle River, Prentice Hall, Pearson Educ., Inc. p. 250–278.

11. Will, E., Faust, J. E. n/d. Growing Media for Greenhouse Production. Agricultural Extension Service. The University of Tennessee. P. 3.

12. Muhammad B.G. 2015. Vegetables Seeding In Cell Trays Technology: A Tool For Achieving MDGs. 4th Applied Research Conference in Africa (ARCA) Conference, Ibadan, Nigeria. p. 24–37.