Fertilizing in containers with exploiting different forms of gardening

Tomasz LESZCZUK - Faculty of Mechanical Engineering, Agriculture and Food Technology Department, Bialystok University of Technology

Please cite as: CHEMIK 2012, **66,** 12, 1360-1365

Introduction

Fertilizing the soil and her all-year-round care is a key to get the good effect of the cultivation both of permanent plants and one-year-old. Fertilizing plants we must remember that each has its specific requirements which next determine the intensity as well as the way of fertilizing [2, 3, 5, 6]. Not unimportant is also kind of soil. More sandy soils are poor into mineral elements and their enriching and feeding plants will be more frequent and more intense. However the humus soil is rich in microelements and they don't require such frequent treatments [9, 11].

Mineral fertilizing influences strongly on the size and quality of crop and ornamental plants. In the horticulture it is simultaneously one of the most expensive treatments [11]. Such situation justifies research centers to seek for technical solutions which enable reducing fertilizers doses and improving effectiveness of their action. At the intensive cultivation with using the highest doses of nitrogen, phosphorus and potassium traditional fertilizing leads unfortunately more often to the environment threat [4, 10, 11].

The horticulture is one of the most intense forms of the agricultural production. Losses arising from improper fertilizing are decreasing the yield or getting the yield of the inferior quality [3, 4]. Quality decrease concerns also such features as reducing plants resistance to illnesses and vermin [5]. Plants not fully fertilized definitely worse are carrying exaggerating into the new seat [6].

Surface fertilizing in the horticulture with the application of spreading disc or pneumatic is impossible because of the small place in the garden. Therefore fertilizing in the horticulture take place with the help of specially constructed applicators and the process is called located fertilizing [4, 10]. In case of using located fertilizing, which relies for putting fertilizer on the soil surface (among others scoring), is easily to seek for big losses of fertilizer and the threat to the natural environment, as a result of flowing nitrates and phosphates to the surface waters. Rowing applying fertilizers mixed with the sowing material in the sower causes most often deterioration of the growths and is impeding the initial plants development. The most rational solution of located fertilizer turned out to be deep applying fertilizer in the vicinity of the seed (of root) [11]. In this case, using the earlier recalled fertilizer applicator, become necessary. The person performing such treatment should have indispensable knowledge about the actual quantity of applied fertilizer [13].

Using the fertilizer applicator, how demonstrated foreign and domestic researches, improve effectiveness of nitrogen, phosphorus and potassium in the cultivation of plants from wide spacing of rows, among others of some vegetables. Increasing the strengthening of fertilizer in the immediate vicinity of the root enables the plant to take elements (NPK) with the minimal energy circulation for the development of the system of lateral roots. Mentioned fertilizing technique is working when a need of applying lots of fertilizers in spring is occurring and when we often deal with the drought [11].

Slowed down fertilizers, called also fertilizers with controlled freeing elements, are a new group of products, recommended peculiarly for the horticulture in container cultivations of the nursery propagation relatively ornamental.

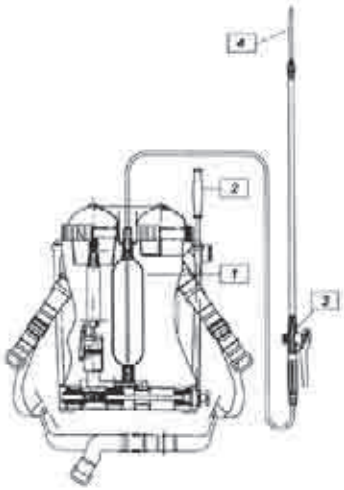
They belong to specially encapsulated slowed down fertilizer with elongated period of freeing the nutrients, dependent on the temperature and the humidity [12].

Aim of the study

An optimization of the dose of examined fertilizers was a purpose of research for ornamentals plants in the container cultivation and determining granulometric composition of fertilizers offered on the Euromarket and comparing their dose administered to the actual quantity to the dose given by the producer of the applicator.

Experimental apparatus

Fertilizers used in the experience were administered with the applicator of the company Quasar of the Polish production. The tankage was 6 litres. Mass of the applicator without fertilizer was 2.5 kg. The scheme of the applicator was presented in the picture 1.



Pic. 1. Scheme of applicator, 1-tank, 2-lever, 3-lance, 4-applicator tip [7] Evaluation of the granulometric composition was made with cribriform method with the mechanical shaker of ø 200 mm, type LPzE-2e of the company MULTISERW-Morek

The research material

Specialist fertilizers, most often applied in the ornamental nursery propagation of the Polish company were provided with examinations: Intermag (Agriform Mg, Hortiform) and slow-acting fertilizer (fertilizers capsular) from the import (Osmocote, Basacote).

Methodology of the research

For the experience was used a two-year-old black pine with bare root systems, which was planted into a pots 0.15 m x 0.15 m. The technique of fertilizer application by the applicator consisted

on putting gardening fertilizer next to the root system of the plant. The application of fertilizers was applied in doses 2, 4, 6, 10 g. Every fertilizer combination included 50 plants, in three levels of fertilizing, times four repeating. Applying the applicator required conversion of cm3 into grams, because all fertilizer recommendations were being given in grams.

Sieve analysis was conducted with method on drily, according to PN [13]. Examining the granulometric composition was conducted on the mechanical shaker, taking into account each time randomly fertilizer sampled of 0.100 g and repeating examinations for each of fertilizers three times. Time of the shaker work was 3 min. Individual factions were being weighed on the electronic weighing scale.

Research results

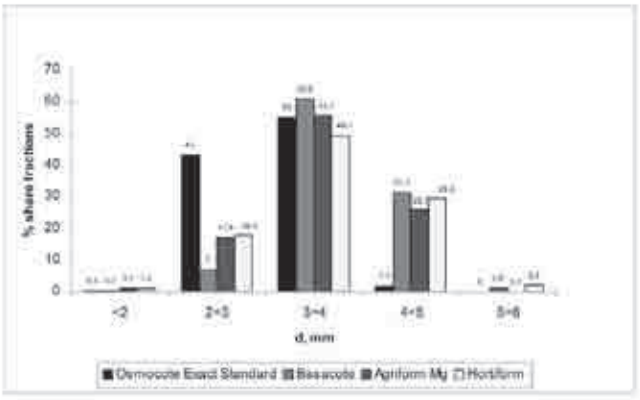
Before the accession to examinations, as a result of the quality evaluation of fertilizers used while located fertilizing, a percentage share of the faction was determined in examined trials. The largest percentage share takes faction 3 ÷ 4 mm (49.1% for Hortiform fertilizer and the 60.6% for Basacote fertilizer). As a result of the examination e.g. Agrofirm Mg fertilizer, was founded that the largest percentage share takes faction 3 ÷ 4 mm (55.7%), next faction 4 ÷ of 5 mm (25.7%) and faction 2 ÷ of 3 mm (17.4%). Research results were presented in the table. 1.

Table 1

Participation of individual factions in examined fertilizers

item	Tested fertilizer	Fertilizer type / Granulated form	Diameter of holes d in the sieve, mm					
			<2	2÷3	3÷4	4÷5	5÷6	>6
			Participation % of faction, mm					
1	Osmocote Exact Standard	Encapsulated / round	0.3	43.0	55	1.7	0.0	0.0
2	Basacote	Encapsulated / round	0.2	7.0	60.6	31.3	0.9	0.0
3	Agriform Mg	Granulated / crushed	1.1	17.4	55.7	25.7	0.1	0.0
4	Hortiform	Granulated / crushed	1.2	18.1	49.1	29.3	2.3	0.5

The graphic percentage schedule of individual factions was presented in the picture 2.



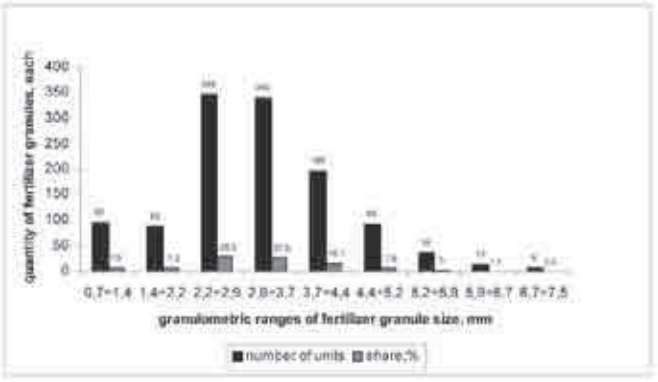
Pic. 2. Participation of individual factions in examined fertilizers

For Hortiform fertilizer were made the cardinality of pieces of granules in individual granulometric fractions. Results were presented in table 2. Ranges of the size of Hortiform fertilizer granules along with their percentage participation were presented in the picture 3.

Table 2

Participation of individual factions in Hortiform fertilizer

item	Granulometric range	Number of granule pieces	Participation, %
1	0.7÷1.4	96	7.9
2	1.4÷2.2	89	7.3
3	2.2÷2.9	348	28.6
4	2.9÷3.7	340	27.9
5	3.7÷4.4	196	16.1
6	4.4÷5.2	93	7.6
7	5.2÷5.9	36	3.0
8	5.9÷6.7	13	1.1
9	6.7÷7.5	6	0.5



Pic. 3. Participation of individual factions in Hortiform fertilizer

The obtained results show, that in the granulometric period 2.2÷2.9 and 2.9÷3.7 appears lots of fertilizer particles, 348 and 340. The large number of particles, 196 pieces, appear also in the range 3.7÷4.4, although this range is not dominating. This may indicate a large degree of the fragmentation of obtained fractions.

Conducted measurements enabled also to establish the relation of the dose of gardening fertilizers administered in grams depending on placing the position on the applicator. Repetitiveness of the dose at next 10 applications (measurements) were presented graphically in the picture 4.

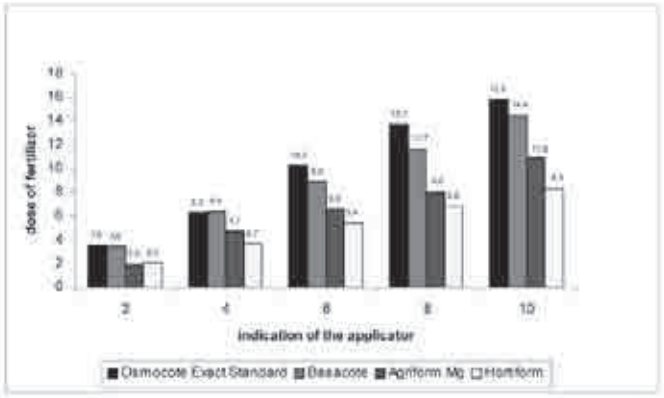
Table 3

Size of administered doses of fertilizer

item	Tested fertilizer	Fertilizer type / Granulated form	Fertilizer dose in grams by position on the feeder, cm³				
			2	4	6	8	10
			Real dose of administered fertilizer, g				
1	Osmocote Exact Std.	Encapsulated / round	3.6	6.3	10.3	13.7	15.8
2	Basacote	Encapsulated / round	3.5	6.4	8.9	11.7	14.4
3	Agriform Mg	Granulated / crushed	2.0	4.7	6.6	8.0	11
4	Hortiform	Granulated / crushed	2.1	3.7	5.4	6.8	8.3

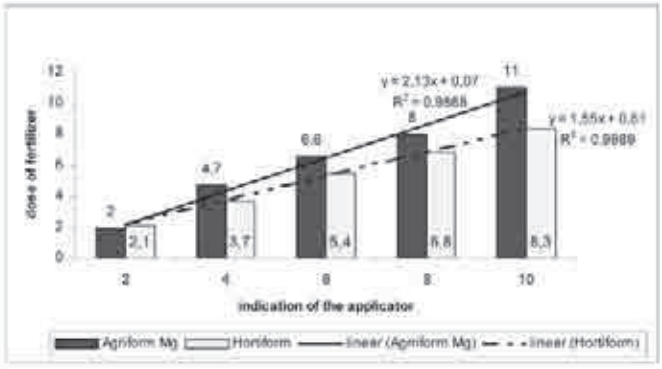
The dose of Osmocote fertilizer by the position 2 on applicator is in initial measurements 3.6 g, and by position 10 oscillate between 15-16 g. The dose of Agriform Mg fertilizer by the position 2 on applicator is administering steadily 2 g of fertilizer. The similar stability of the dose is appearing by position 8, whereas by position 10 the stabilization was to 11 g. Big divergences appeared during the application of Basacote

fertilizer, where at scale 4 placed on the applicator, a real administered amount of fertilizer is 6.3 g. Position 10 on the applicator, results in the application of the same fertilizer with dose 14.4g. Table 3 contains conclusions of the application of individual fertilizers.



Pict.4. Influence of the size of a fertilizer dose on the applicator to the actual value of the dose in grams

Conducted measurements enabled to establish fertilizer administered in grams to the relation of placing the position on the applicator, what was described in the picture 5 for granulated fertilizers: Agriform Mg and Hortiform.



Pic. 5. Divergence of the dose resulting from the granules kind

Below, the following forms of the function, letting to convert the position into the dose:

1. y=2.13x+0.07; for r=0.98 for Agrofirm Mg.
2. y=1.55x+0.61; for r=0.99 for Hortiform

where:

y – dose applicator, g

x – position on the applicator (x = 2, 4, 6, 8, 10),

r – linear correlation coefficient

Conclusion

The divergence of the administered dose on the applicator towards to the obtained dose of fertilizer is different from the kind of used fertilizer. From measurements of the dose of fertilizer administered at all arranged position of the applicator, results that it depends on the kind of fertilizer, composition of its faction (granule diameter distribution). Better application properties have granulated fertilizers, in the crushed form and whole pellets than pelleted fertilizers. From examined fertilizers Agriform fertilizer is characterized by the greatest evenness of Polish production towards

Osmocote and Basscote fertilizers coming from import. Thus, it becomes necessary to check the fertilizer by the change in grain size: crushed for round granulation occurring in encapsulated fertilizers. It was also found that the actual dose (y) of fertilizer applied at the given setting (x) position can be calculated from the linear relationship:

for fertilizer Agriform Mg, y = 2.13x + 0.07; r = 0.98

and for fertilizer Hortiform, y = 1.55x + 0.61; r = 0.99.

Fertilizer applicator's Quasar should be modified taking into account the operational user comments.

Determining the actual dose of applied fertilizer will use to reject the arguments put forward in the pre-article, that increase of the fertilizer concentration in the immediate vicinity of the root enables the plant taking components (NPK) with a minimum of energy for the development of lateral root system, not only vegetables grown by farmers, but also ornamental plants in horticultural nurseries [11].

Literature

1. Biskupski A., Granulation methods used in the domestic factories of fertilizer plants and properties of the obtained products, Chemist, 2008, **9**, 398-408,
2. Biskupski A., Malinowski P., Igras J., Borowik M., Podleśna A., Schab S., Nitrogen fertilizer pellets – current state and prospects of development in Poland, Chemical Industry, 2009, **88**/**12**, 1337-1341,
3. Chodura P., Doses of Fertilizer, Fertilizers and support for growing in a field, Plantpress Publishing House, Cracow, 2010, 18-21,
4. Chodura P., Fertigation – an effective method of fertilization, Fertilizers and support for growing in a field, Plantpress Publishing House, Cracow, 2010, 24-34,
5. Górecki H., Effect of fertilizers and fertilization on the environment, Chemical Industry,2002, **81**/**10**, 635 643,
6. Kubiak J., The application of a slow release fertilizer in the ornamental nursery, Problems of Agricultural Engineering, 2005, **4**(50), 35-42,
7. Kubiak J., Research of the Hortiform granular fertilizer applications for the container growing, Application Research made for the company Intermag, 2010, 2-8,
8. Kubiak J., Willow mycorrhiza – a preliminary study, Agricultural Engineering, 2007, **3**(91), 105-110,
9. Kubiak J., Technique of precise fertilization ornamental shrubs in container growing, Agricultural Engineering, 2007, **9**(97), 79-86,
10. Kubiak J., Fertilization technology in container growing of ornamental shrubs with granulated fertilizers and foliar of mycorrhiza, Plant Engineering Problems, 2006, **1**(51), 111-118,
11. Nowakowski M., Row fertilization technique of sugar beet, Agricultural and Technical Overview, 5, 2004,
12. Żywociński K., Gozdecka G., Korpal W., The use of aqueous polymer dispersions for encapsulation of granules fertilizer, Chemist, 2011, **65**, 4, 347-352,
13. PN-ISO 2591-1: 2000. Sieve analysis. Methods of using the control sieves of woven wire and perforated plate.

Translation into English by the Author

MSc. Leszczuk THOMAS is a graduate of the Mechanical Faculty of Białystok Technical University (1999). Scholar of the project: 'Improving the potential of higher education as an economy factor developing based on knowledge" co-financed by the European Social Fund of the European Union. Currently a PhD student at the Mechani-cal faculty of Mechanical o of Białystok Technical University. Specialty: construction and operation of machinery, non-pressure agglomeration of fine and powdery materials.

email: tomasz.leszczuk@wp.pl; mobile.: 609 657 102