INNOVATIVE PROCESS FOR SOIL TILLING IN SMALL INDIVIDUAL FARMS

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Abstract.*This paper aims to present the special advantage of a new model of hand tool for tillage the soil in gardens and protected areas of small individual households, the so-called "miracle shovel" compared to other models of classic hand tools. It is very important for all supporters of organic farming to keep the structure of the soil during its processing. Working the soil with a regular tool requires a lot of physical effort and unpleasant pain in the lower back.The new tool model is an invention that has revolutionized the category of gardening tools. It has an ingenious, simple design and can be used as a tool that simultaneously performs the functions of fork, shovel and rake, simultaneously performing digging, harrowing, weeding, loosening and smoothing the soil. This tool was designed not only to make work easier, but also to improve the quality of work and increase labor productivity 2-3 times.The principle of operation of this tool is very simple. Due to the lever system, the mobile "forks" go through the fixed ones; fixed on the frame, carefully loosen the ground, as if we "comb" it with a comb. The soil is loosened to a depth of about 25 cm and a width of 43 cm without cutting the weed roots, which prevents them from spreading. Thus, weeds can be easily pulled by hand and the ground remains clean. It is no longer necessary to use the rake later because the soil remains loose and soft.In addition, it does not destroy the fertile layer on the surface by turning the furrow. Another advantage compared to a conventional tool is the conservation of the natural environment, the soil is not only loose, but is also sifted evenly. This allows the removal of overgrown weeds, keeps the soil moist, improving gas exchange, as a result of which the plants will receive more nutrients. Therefore, this tool is a reliable tool appreciated by many farmers and helps to work the soil effortlessly significant.*

Keywords: *innovative procedure, manual tool, miracle shovel, soil processing, small individual households*

INTRODUCTION

The soil cultivation process is the basis of most of the culture technologies (OANCEA, I., 2012). Soil work aims to create the fertility conditions of the soil. Soil processing processes are among the most energy-intensive and labor-intensive processes (POMOHACI, T.I., 2016). These processes are accompanied by intense wear of work organs. In addition, they still produce a particularly dangerous negative phenomenon, given the impossibility of its complete and immediate removal, namely soil compaction (VLAD, C., 2013). This phenomenon is even more dangerous on small surfaces (gardens, greenhouses, and solariums), due to the weight of the equipment used and the large number of maneuvers for carrying out the working process (BĂISAN, I., 2016). Therefore, in such situations it is recommended to use manual or small mechanization tools (VOIT, H., 2010).

Very common is the usual shovel (spatula, spade), but which requires a great effort. The classic shovel raises tons of earth during work and can affect the health (the back) of the user. In addition to this tool the weeds are cut into pieces and left in the soil and can be multiplied quickly (MĂRUNȚELU, I., BRĂTUCU, GH., 2019). With this new type of tool, which is based on the "upside-down effect", soil working in gardens, greenhouses and solariums can also be done by elderly people, children or even people suffering from diseases of the spine.

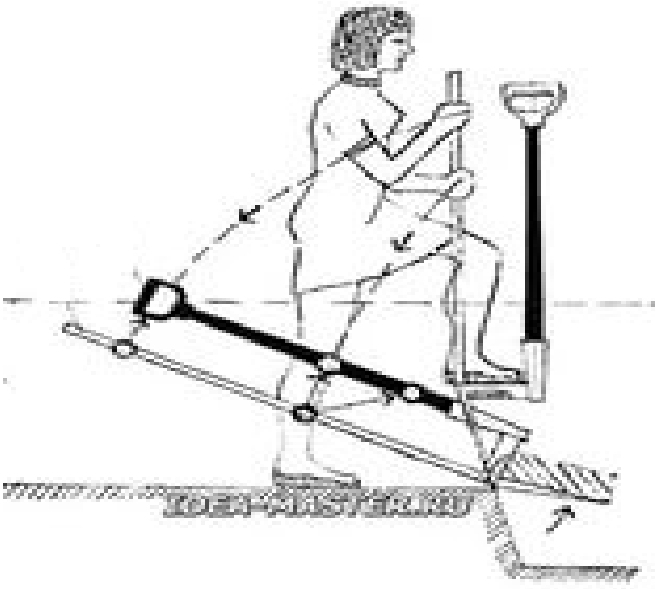

Figure 1. The work process done with the miracle-shovel

Thus, this tool offers the opportunity to approach the groundwork in a completely new way. It significantly reduces the amount of effort required to dig the soil and can turn the gardener's day-to-day work into an easy and even fun training.

MATERIAL AND METHODS

The experimental study was carried out in my own native garden in March 2020, on two terrain surfaces measuring 10 meters long and 5 meters wide, using a classical tool and the innovative ''shovel-wonder''.

As a classic tool I used a C-type spade used on light soil for the gardens. This is executed by pressing from steel sheet of 2 mm thick, width 225 mm, blade length 300 mm, weighing 1100g (BUZATU , I. ET.AL.,1984; SULEA,I., TRANDAFIR,S.,1966).

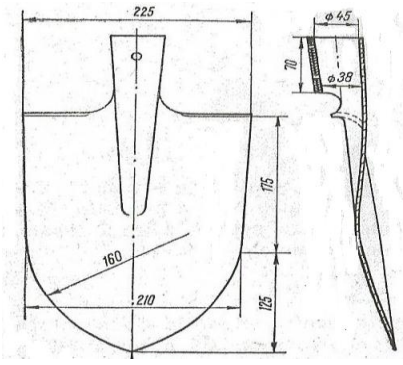

Figure 2. The C-type spade

The modern used tool is the miracle shovel of Fig. 3, consisting of a hinged corner fork 1 and a frame with a counterfeit 2 (MĂRUNȚELU, I., BRĂTUCU, GH., 2019).

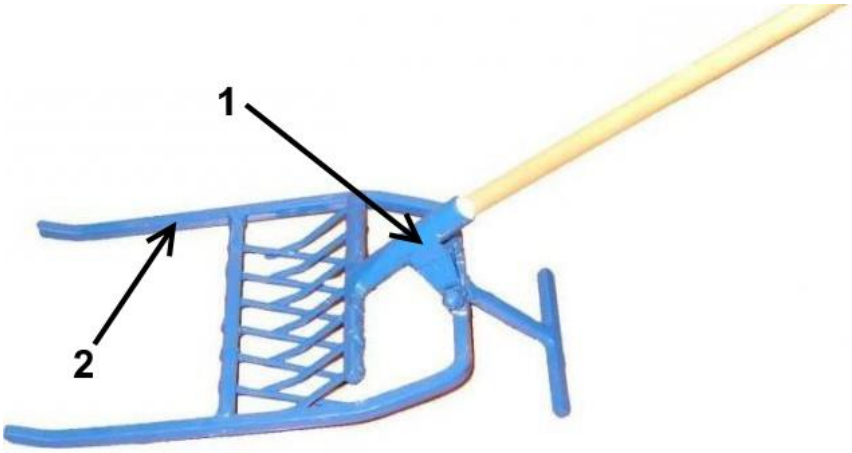

Figure 3. The miracle – shovel

Collars are the active organs of the tool in the form of sharp bayonets at the tips. The tool is made of steel with a width of 430 mm, with the dimensions shown in Fig. 4.

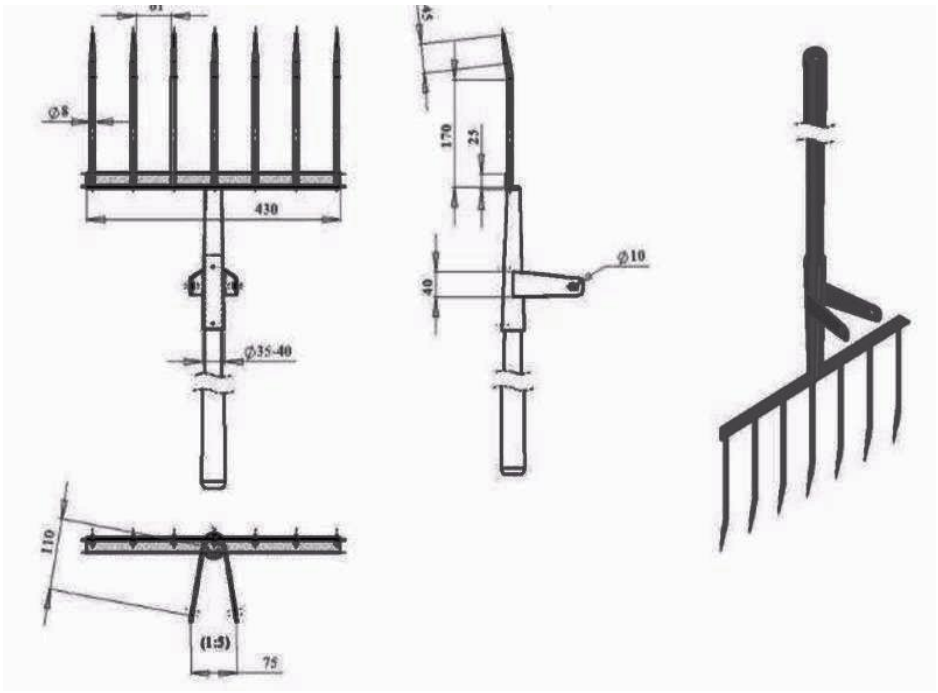

Figure 4. Constructive parameters of the miracle- shovel

Figure 5. The work done with the two tool models (photo by Ion Mărunțelu)

RESULTS AND DISCUSSION

To perform a comparative study of the work process performed with the two tool models, we timed the working time for digging the two surfaces and passed the values in the following table:

Table 1

The surface worked in time by each tool

Time [s]	The surface worked with tool 1 (the classic shovel) [m²]	The surface worked with tool 2 (the miracle shovel) [m²]
0	0	0
600	4,8	9,6
1200	9,4	20,4
1800	14,6	30,8
2400	19,0	40,4
3000	23,4	50,0

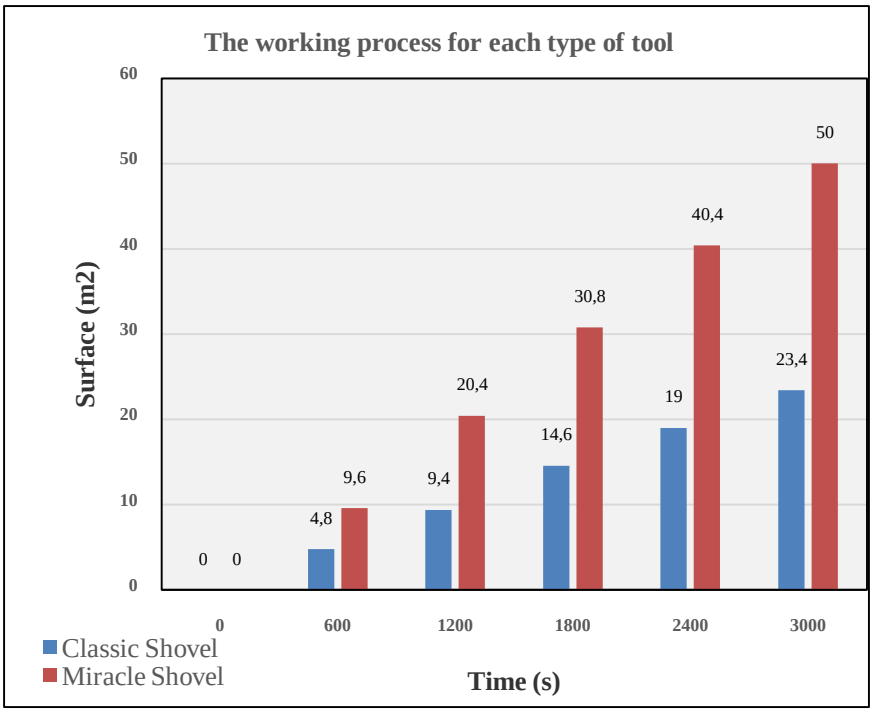

Figure 6. The graphical representation of the worked surface of each type of tool in time

From the analysis of the measurements, it results that the same field surface can be worked with a shovel - a miracle in less than half the time required for the classical tool and also with reduced physical effort.

CONCLUSIONS

- Simplicity of design minimizes the effort on the spine and hands; the inclination of the back during the work process being insignificant, almost absent
- Ensures at one pass a working width almost double to an ordinary tool
- Due to the fact that during the working process the ground layer is not overturned, it results that the most fertile top layer is preserved. Therefore, the vital activity of beneficial microorganisms in the soil is not affected, which leads to a considerable increase in yield.

BIBLIOGRAPHY

BĂISAN, I., 2016 – Culturi agricole protejate (Protected Crops), Iași

BUZATU , I. ET.AL.,1984 – Unelte și utilaje agricole de mică mecanizare (Tools and agricultural machinery of small mechanization), Publishing House Ceres, Bucharest

MĂRUNȚELU, I., BRĂTUCU, GH., 2019 - Adaptarea Unei Unelte Manuale De Lucrat Solul La Un Proces De Lucru Mecanizat (The Adapting Of A Manual Tool For Working The Soil To A Mechanized Work Process), Research Journal of Agricultural Science 51(4), pp.81-88, Timișoara

OANCEA, I., 2012 – Tehnologii Agricole Performante (High-Performance Agricultural Technologies), Publishing House Ceres, Bucharest

POMOHACI, T.I., 2016 - Pregătirea Patului Germinativ În Condiţii Grele De Lucru (Seed Bed Preparation In Difficult Conditions), PhD Thesis, Iași
SULEA,I., TRANDAFIR,S., 1966 – Unelte și utilaje agricole de mică mecanizare (Tools and agricultural machinery of small mechanization), Agro-forestry Publishing House, Bucharest
VLAD, C., 2013 - Cercetări Privind Optimizarea Energetică A Procesului De Pregătire A Patului Germinativ La Înfiinţarea Culturilor De Legume (Researches Regarding The Energetic Optimization Of The Germination Bed Preparation Process For Vegetable Cultures), PhD Thesis, Brasov
VOIT, H., 2010 – Grădina de legume (Vegetable Garden), Casa Publishing House, Bucharest
*** https://stroychik.ru/tools/chudo-lopata-svoimi-rukami
*** https://www.olx.ro/oferta/cazma-sapa-minune-furca-pentru-sapat-gradina-afanator-prasitoare-ID5l1hk.html
*** https://vsaduidoma.com/2013/06/12/chudo-lopata-i-drugoj-sadovyj-instrument-dlya-ryxleniya-i-perekopki/
*** https://www.spas-agro.ru/vyrashhivanie/chto-takoe-chudo-lopata-opisanie-protsessa-izgotovleniya-instrumenta.html
*** https://www.icpa.ro/documente/coduri/Cum_poate_fi_lucrat_solul.pdf
***https://www.google.com/search?source=univ&tbm=isch&q=chudo-lopata&client=firefox-b-d&sa=X&ved=2ahUKEwjXkYrt5abrAhUGaBoKHfOTDhEQsAR6BAgJEAE&biw=1525&bih=7
***https://thebridgestudio.ru/ro/chudo-lopata-luchshie-modeli-i-pravila-ispolzovaniya-chudo-lopaty-prisposoblenie-dlya-kopki-zemli-svoim.html
*** https://optbay.ru/chudo-lopata-tornado/reviews/