Main parameters of manure sealer

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Abstract. The purpose study is to substantiate the main parameters of the slitter for embedding manure in the soil. A slitter has been developed for lifting the formation, forming a gap along the manure strip lying on the surface of the field, pushing it into the gap, and leveling the gap with soil. The slitter includes a rack, large and small cheeks connected to a soil-supporting plate, made with an increasing slope from the bottom to the top towards the small cheek and adjacent to the soil-supporting plate. A window is made in the big cheek for the passage manure. The large cheek is somewhat pushed forward relative to the soil-bearing plate, and its front face is pointed. It is established that when planting fertilizers, the following operations must be carried out: lifting the formation, forming a gap along the manure strip lying on the surface field, pushing the latter into the gap, and leveling the gap with soil. The most acceptable for lifting the formation and the formation of a gap is the working bodies dump type. The following optimal values of the parameters slit are established: the large removal cheek is 710 mm, the width is 200 mm, and the length and height window are 550 and 250 mm, respectively.

1 Introduction

The main task of agricultural production is to increase soil fertility and obtain high sustainable yields. Domestic and foreign experience shows that this can be achieved only with the use of a rational amount of organic and mineral fertilizers.

The value of organic fertilizers lies in the fact that they contain complex nutrients and trace elements necessary for plant development: nitrogen, phosphorus, potassium, calcium, magnesium, iron, cobalt, etc. Therefore, when organic fertilizers are applied, the stock of mobile nutrients in the soil is replenished, which serves as an important condition for improving the circulation of macro- and microelements in the soil-plant system.

Organic fertilizers improve the physical properties of soil, moisture absorption capacity, and other indicators that characterize its fertility. Therefore, the systematic application of organic fertilizers is one the most important methods of soil cultivation, which allows to obtain high and stable yields over the years.

The centuries-old practice of agriculture has proved that manure is an effective means of increasing soil fertility and crop yields. Even in the recent past, melon crops were practically not cultivated on the irrigated lands republics Central Asia without manure. The rotted manure was brought into a hand-made hole (hanzhuvars), sprinkled with soil, and then sown seeds. This made it possible to increase the yield of melons by 10-30 % and improve the taste of the fruits.

In the future, with the expansion of acreage, the development of technology, the increase in the production of mineral fertilizers, and the transition of agriculture to intensive forms of cultivation, native methods will have a way to more high-performance methods. Almost everywhere, there has been a transition to the use of mineral fertilizers, despite the fact that many studies have proven the need to use organic fertilizers.

It is known that fertilizers should be applied to the soil in such a way and in such a place that they are most accessible to plants, i.e., it is necessary that fertilizers are only in those layers of soil where the root system plants develop. It is proved that the effectiveness of manure with local (tape) application is the greatest.

Tools and the type of working bodies for the implementation process of manure embedding in the soil must meet the following conditions and requirements:

1. Working bodies for manure sealing will work in the soil on a pre-sowing background.
2. The tool must ensure the sealing of three strips of manure lying on the surface field and sown atherate15-20t/ha at the same time.
3. Manure should be sealed to a depth of 10-30 cm at a distance of 0-20 cm from the future row of plants.
4. There should be a layer of clean soil above the manure.

In connection with these requirements, it is necessary to carry out such operations as lifting the formation, forming a gap along the manure strip lying on the surface field, pushing it into the gap, and leveling the gap with soil. The rise formation, the formation of a gap, can be carried out by a working body dump type, in which the design dump should ensure the preservation of the gap during the time during which the process of pushing manure into the gap will occur, and in the future it is necessary that as much as possible soil crumbles from the dump back into the gap.

D. Chuyanov[1,3], M. Salimzyanov[2], Y. Syromyatnikov [4,8,9,17,18], M. Kostenko[5], F. Maiviatov [6,10], M. Edrris [7], S. Hrushetsky [11], F. Mamatov [12,13], M. Kalimullin [14,15], A. Semenov [16], K. Romaneckas [19] and E. Sagaiskisym [20] justified the parameters process lifting and complete turn over reservoir.

The unevenness of manure sealing during pre-sowing local application organic fertilizers is mainly influenced by the parameters slitter (Fig.1), which includes a rack, large and small cheeks in height, connected at the top soil

by a lifting plate made with an increasing slope towards the small cheek as it rises. A window is provided in the large cheek, the parameters which are selected from the conditions for passing through it the maximum norm manure mixed with soil. The large cheek is slightly pushed forward relative to the small one, and its front face is pointed; therefore, the deformation of the soil occurs during the operation plowshare, and the soil lifting plate does not extend towards the manure tape lying on the surface field. Therefore, the justification parameters working bodies for embedding manure into the soil was carried out, taking into account the technological features of process embedding manure for melon crops and the physical and mechanical properties and soil melon-growing zone of Uzbekistan.

The designated purpose study is to substantiate the basic parameters slitter for embedding manure in the soil.

2 Materials and methods

Thetechnologicalprocesssealingfertilizersusingslitsisasfollows.Ontheframeunitforembedding manure into the soil, the slits are installed so that when the unit is moved, the belts unit(previously sown by the manure-raising unit) are located on the side large cheek. When working, thesoil cut by the ploughshare moves along the soil-bearing and soil-supporting plates and is kept fromshedding between the cheeks, thereby forming a space (gap) free soil. The colliders move the manureto the window big cheek during which the manure ismixedwith the soil and push the resultingmixture to the bottom gap. After that, the soil, crumbling from the soil-supporting plate, falls asleepwith manure. Thus, by adjusting the depth stroke working body for manure sealing, it is possible to ensure that the manure is located only in the root layer soil and is covered with soil from above.

Experiments to substantiate the main parameters slitter were carried out in the experimental farmResearch Institute of Agricultural Mechanization. The optimal distance from the upper, anterior pointlarge cheek along the movement unit to the upper anterior point its connection with the soil-bearingsurface (in the future, the removal of the large cheek) is determined by the mass soil thrown aside bythe manure tape lying on the surface of the field. The removal was considered optimal, in which thesoil rejection was minimal, since the width its flow in front dumper, and therefore the parametersslitter,dependsonthemasssoilthrowntowardsthe manure[1,2].

Measurements were carried out as follows. The manure-making unit was stopped every 10 m. Thentwo metal sheets were taken,one of which (0.25 x 0.25) was placed on the surface field at a distanceof25cmfromthelargecheek,andthesecond(0.4x0.25)onitsothatthelongsideisperpendicularto the cheeks of the slitter. Then the top sheet was moved close to the big cheek. The soil found on thetopsheetwascollectedandweighed.

Before conducting the research, the main characteristics of manure were determined according toGOST28718-2016."Machinesforapplyingsolidorganicfertilizers.Programs andtest methods".

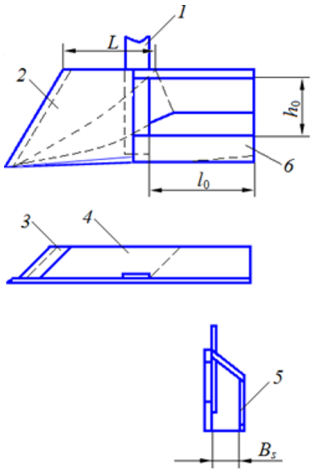

Figure 1. Theschemeexperimentalslotmachine:1-stand 2-bigcheek; 3-aploughshare; 4-asoil-liftingplate; 5-asmallcheek; 6-afieldboard.

Experiments were carried out with semi-ripened manure at a rate application 20 t/ ha. Before theexperiments, the average bulk density, humidity, and starriness manure particles were determined, which are equal to 686kg/m^3, 51.5% and 33.68%, respectively.

3 Results and discussion

The width grip slitter, and, consequently, the width slit should be such that all the manure mixedwith the soil collided with the collider can fit in it. In addition, it is necessary that the manure after the passage crevice was covered with a ten-centimeter layer soil.The recommended depth manureem bedding is 25-30 cm,so the thickness its layer canbe15-20cm.

In order for there to be no manure left on the surface field, after sealing it, it is necessary to cut offsuchalayersoil,withinwhichthedepth thislayershouldbeatleast30cm. Therefore, the cross-sectional area slit to be cut should be equal to or greater than the sumcross-sectional areas manure layer to be sealed with the soil and a ten-centimeter mound above it, i.e.(Fig.2)

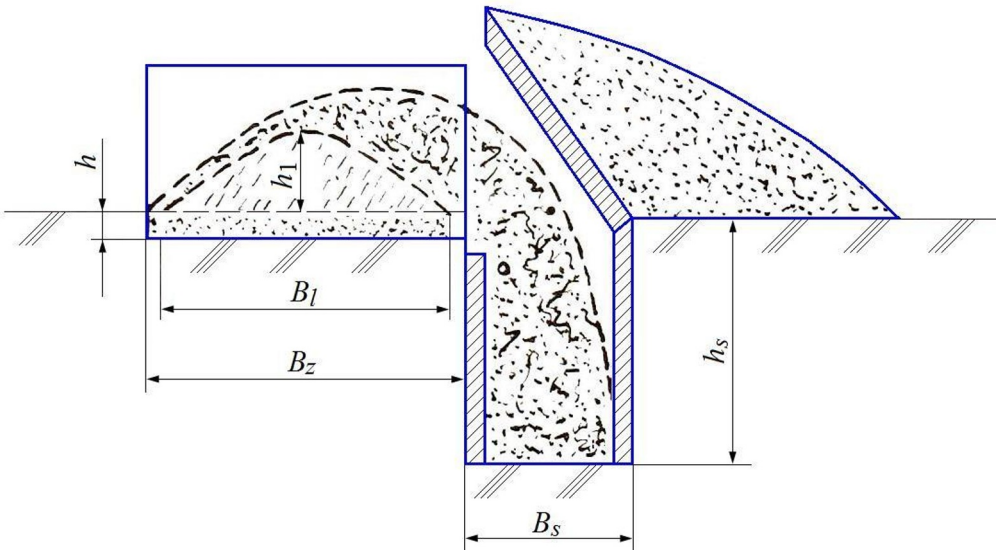

Figure 2. Technologicalschememanureembeddingin thesoil

$$B_S(h_s - h_{uk}) \geq \left(\frac{B_l h_1}{2} + B_z h\right) K_c, \tag{1}$$

where from

$$B_S \geq \left(\frac{B_l h_1 + 2B_z h) K_c}{2(h_S - h_{uk})}\right)_c, \tag{2}$$

where Bland h_1– are the width and height manure roll; B_z– is the width collider's grip; h– is the thickness soil layer cut off by the collider; h_s– the depth gap or the depth of manure sealing; h_{uk}–thickness covering layer of the soil; K_c– is the coefficient off luffiness mixture manure with soil. The Kcco efficientis equal to the ratio average volume mass manure-soil mixture before the passage to ol to the volume massmanure-soil mixture on the collider.

Experimental studies have established that when manure is embedded in the soil, the K_c coefficient is1.0-1.05.

It can be seen from formula 1 that the width slitter mainly depends on the thickness and width sownmanure and the cut soil layer, the permissible thickness of the manure layer introduced into the soil, as well as the coefficient of fluffiness manure-soil mixture.

Research results (Fig.3) show that an increase in the removal large cheek *L* from 230 to 710 mmleads to a sharp decrease in the mass thrown aside by the manure soil. A further increase in thisremoval is impractical, since it leads to a decrease in the strength large cheek and an increase in theangle its entry into the soil as.At L=710 mm, the angle entry is 650. A further increase in the angle entry leads to anincrease in the face the cheek with plant residues.

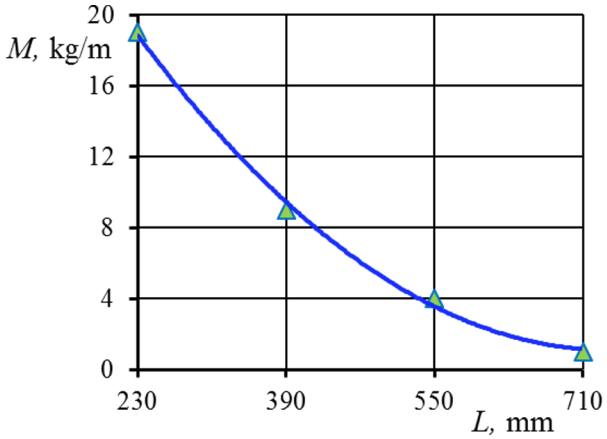

Figure 3. The dependence mass soil thrown towards the manurerollontheremovallargecheek

The depth manure sealing is mainly influenced by the width and depth slit cut by the slitter. Thedepth cutting the gap is dictated by the optimal depthmanure sealing, and the widthgap should besuch that all the manure dumped by the collider is located in it and there is a ten-centimeter layer soilwithout manure above it. The maximum depth manure embedding is 25-30 cm, so the thickness of itslayercanbe15-20cm.

The research results shown in Fig.4 show that with a decrease in the width gap from 250 to 150mm,thethicknessofthemanurelayerwiththesoilpushedintothegap increasedby1.8times.

With a further decrease in the width gap, the sealing fertilizers to the desired depth does not occur,becausethe volume collided mass exceed sthesize gap.

Based on the obtained research results, it can be argued that the width of the slit, and therefore thewidthof theslit,shouldbe200mm.

The length and height of the slit window should be such that fertilizers pushed into the slot passthrough the window with out delay.The results of studies of the dependence ofthe width of the drawing prism in front of the collider on the length and height of the window show (Fig.5 and 6) that when the length and height of the window is less, respectively, 450 and 150 mm, a mixture of manure and soil accumulates, as a result, the technologi cal process of fertilizing is disrupted.

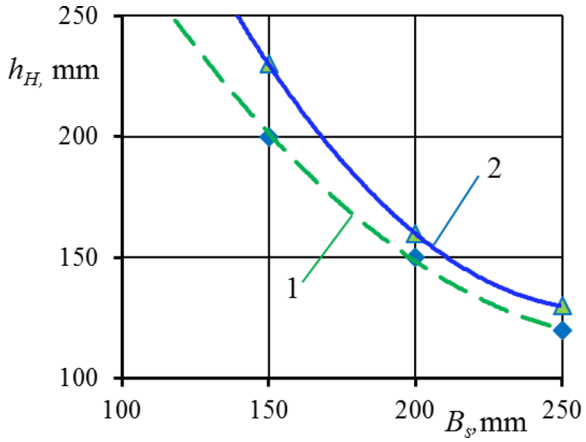

Figure 4. The thickness manure-soil mixture layer depending on the width gap:1-theoretical;2-experimental

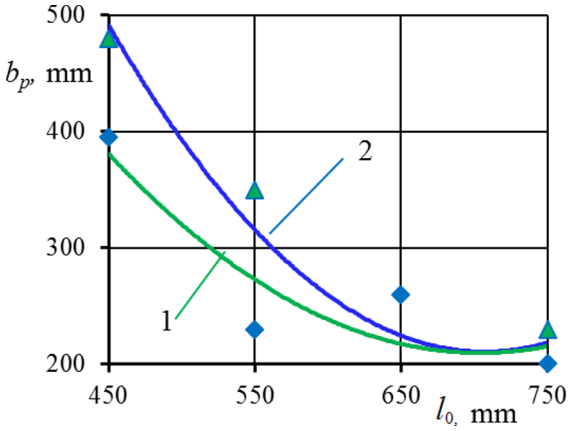

Figure 5. Dependencedrawingprismwidthwindowlength, b_p=f(l0).

With the length and height window, respectively, 450 and 250 mm of the width drawing prism infront collider decreases sharply, and with further increase it stabilizes, i.e. the size window ceases toaffecttheprocesspushingfertilizersintotheslot.Therefore,theoptimalsizewindowcanbetakenasalengthof550mm,andaheightof250mm.

4 Conclusions

The slitter provides sealing of 20 t/ha manure with a layer thickness of 15-20 cm, with the following values its parameters: removal large cheek 710mm, width 200mm, length and height window,respectively-550 and 250mm.

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