Primary Cleaning Machine for Small and Medium-Sized Mung Bean Grains for Farms and Peasant Farms

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Abstract. The article provides information on the current state of cultivation of mosh grain, technology and means of harvesting crops grown in Uzbekistan, the need to clean mosh grain. There is also information about the technological scheme of the primary cleaning machine, the experimental version, the results of economic tests, which divided the developed mosh grain into fractions.
Key words: population, grain, harvest, nutritious, beans, cultivation.

1 Introduction

Today, one of the urgent tasks is to ensure food security and meet the demand of the population for protein-rich agricultural products [1-4]. In this regard, the importance of legumes, including mung beans, is quite high. Mung beans are legumes that have a high nutritional value. The digestibility of the protein in it reaches 86 %. Mung bean grain contains 24–28 % protein, 8 % lysine, and 7 % arginine. Mung bean grains are 1.5–2.0 times more nutritious than wheat and rye grains, and 1.5 times more nutritious. Mung beans are an ancient crop that entered agriculture 5–6 thousand years ago.

The provision of food security is influenced by a huge number of different factors: legal development [5-10] and the introduction of digital technologies [11-18].

According to the World Food Organization (FAO), 5.3 million people die each year worldwide because of the tons of mung beans grown. Approximately 90% of the crop is grown in Asia. India is a world leader in mash cultivation and consumption. Tons are harvested, and 1.3 million people are employed in the country each year [19-24].

2 Materials and methods

In recent years, the volume of mung bean cultivation and exports in Uzbekistan has been growing. To double the yield from the land, replant crops, earn additional income, and

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improve soil fertility, mung beans are being planted on the bulk of the land cleared of autumn grain on farms and peasant farms (Figure 1).

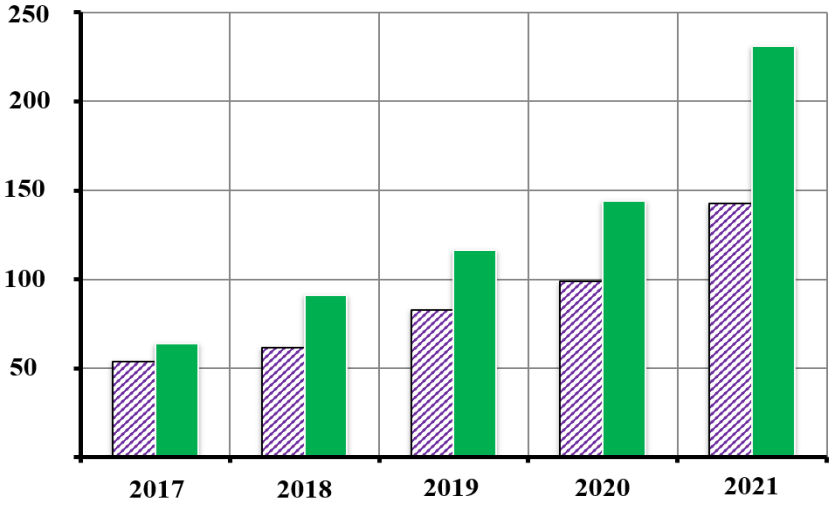


Fig. 1. Diagrams of mung bean area and gross yield grown in Uzbekistan: – seeded area, thousand ha; – gross crop, thousand t.

The crop is harvested using grain harvesters and various grinding devices using a two-phase method to separate the grain (Figure 2) [25, 26].

a b

Fig. 2. The current technological process of mung bean harvesting: a – harvesting using a Keys-2166 grain harvester; b – harvesting using "Demireller" grinding machine made in Turkey.

Experiments show that since the purity of milled mung bean grains is lower than the basic standards and the humidity is slightly higher, they must be quickly passed the initial cleaning stage. This is because grains with high humidity heat up spontaneously within 2-3 days, resulting in a sharp decrease in grain consumption and seed quality [27-29].

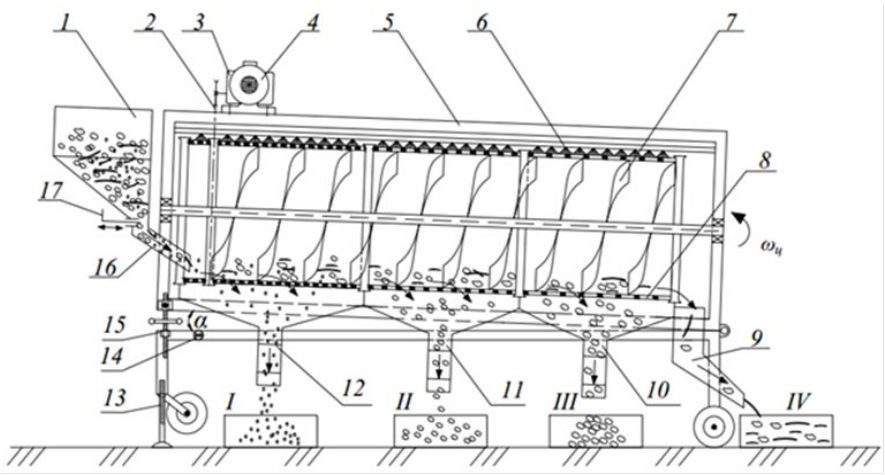
When the grain is first cleaned and brought to the required level of cleanliness, it dries due to the passage of wind between the grains, prevents spontaneous heating during storage in warehouses, reduces pest infestation and increases fragility. As a result, costs will be reduced due to the simplification of the work of the next technological process [30-35].

Today, on farms and peasant farms, mung bean grain is cleaned and sorted by size using primitive methods, that is manual wind or various non-scientifically based hand-held

cleaning devices. This, in turn, increases energy and labor costs, leading to a sharp increase in production costs.

3 Results and discussion

Therefore, on the basis of the analysis of research work on the design and technological processes of grain cleaning machines and the physical and mechanical properties of grain, Scientific-Research Institute of Agricultural Mechanization (SRIAM) and "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" In collaboration with scientists from the Research University, the first cleaning machine was developed for farms and peasant farms by separating small-sized mung bean grain into fractions (Figure 3).



1-bunker; 2-band extension; 3-reducer; 4-electric motor; 5-rama; 6 th brush eye cleansing brush; 7-screw guide; 8-cylinder cylinder; 9-major compound drop trough; 10-large grain fall trough; 11-small grain fall trough; 12-the groove through which small compounds fall; 13-bases; 14-cylindrical sieve defining horizontality; 15-screw slope adjusting screw; 16-grain pipe to the sieve; 17-quantifier
containers for I, II, III and IV separated fractions

Fig. 3. Technological scheme of the first grain cleaning machine.

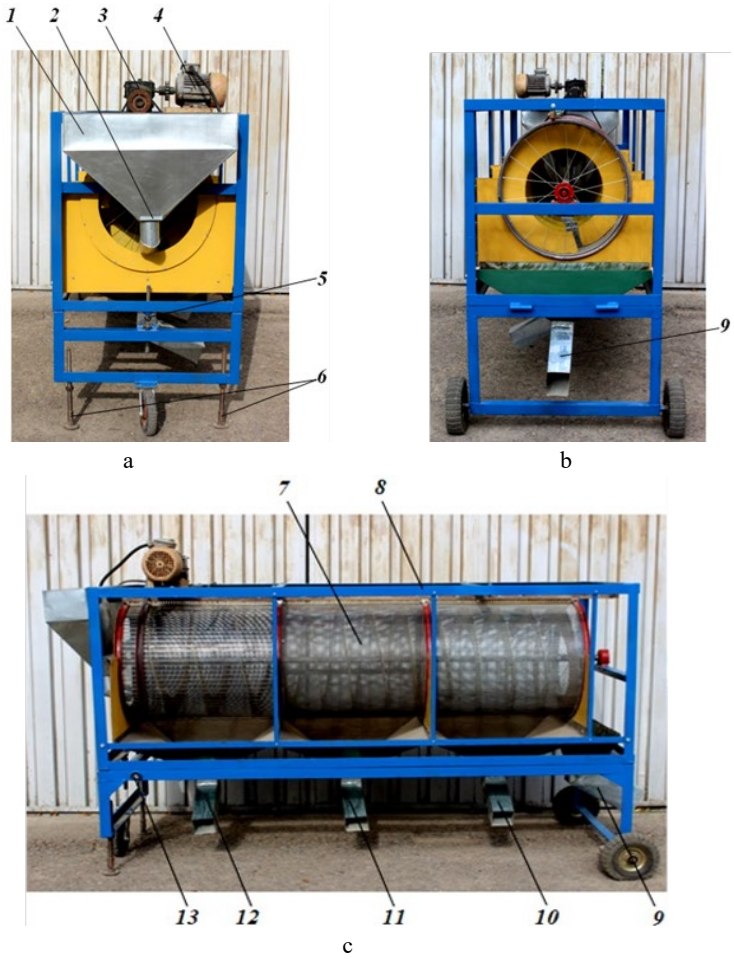
The working process of the machine is as follows: the grain mixture is calibrated from the bunker 1 using a meter 17 and transmitted to it from one end of the cylindrical sieve 8 using a pipe 16. The cylindrical shaft 8 is driven by a torque transmitted from the electric motor 4 through the reducer 3 by means of a belt drive 2. The grain mixture entering the sieve moves towards the second head of the sieve as a result of the rotation, slope and mainly the screw head 7 of the sieve and sifts on the inner surface of the sieve, removing small and large compounds and separating the grains by size.

The cylindrical sieves are assembled by combining three cylindrical sieves of different shapes and sizes. The first 1/3 of the side by which the bunker is located has elongated eyes with a sash size of 2.5x20 mm. In this section, the fine impurities, crushed, broken and loose grains of the grain mixture pass through the sieve and are collected in vessel I through 12 through which the fine impurities fall. The grains and coarse joints that do not pass through the sieve continue to move under the influence of the screw guide 7 and continue to sieve in the second 1/3 of the cylindrical sieve. This part of the sieve has round-eyed holes with a diameter of 3.8 mm, which separates the grains up to 3.5 mm wide. The separated grains are collected in vessel II through trough 11. Grains larger than 3.5 mm in size and

large joints pass into the last 1/3 of the cylindrical sieve and continue to sieve. This section consists of a round-eyed sieve with a size of 5.5 mm, through which all the grains pass through its eyes and are collected in a vessel III for large grains through 10. The large compounds that do not pass through the sieve eye come out at the end of the cylindrical sieve and descend through the trough 9 to the vessel IV, where the large compounds are collected.

The machine is put into operation using the supports 13. The slope of the cylindrical girder is adjusted by means of a screw hoist 15, and the horizontality is controlled by means of a frame 14 mounted on a frame. When the supports 13 are lifted, the machine leans on the wheels and enters the transport mode.

An experimental copy of the developed cylindrical sieve was prepared for practical testing of the first cleaning machine by fractionation of the mung bean grain (Figure 4).



1-bunker; 2-quantitative barrier; 3-reducer; 4-electric motor; 5-screw slope-changing screw; 6-base; 7-cylinder cylinder; 8-frame; 9-major compound drop trough; 10-large grain fall trough; 11-small grain fall trough; 12-the groove through which small compounds fall; 13-a fairness that defines the horizontality of a cylinder valve.

Fig. 4. An experimental version of the first mung bean grain cleaning machine:
a – front view; b – view from the back; c – side view.

Experimental version of the machine bunker 1, dosing barrier 2, reducer 3, electric motor 4, sloping screw 5, base 6, cylindrical sieve 7, frame 8, large joints 9, large grain 10, small grain 11, consists of a trough 12 through which small joints fall, and a fair 13 which defines the horizontality of a cylindrical sieve.

4 Conclusion

With the help of an experimental version of the machine, grain is being cleaned and distributed to fractions of grain size by farmers and peasant farms and private landowners. The results of the study of the composition of refined grains showed that the completeness of the separation of fine mixtures in the grain was 98.4 %, the completeness of the separation of fine-grained grains was 98.7 % and the separation of coarse grains was 100 %.

When farmers and private landowners use the primary cleaning machine to clean and sort the grain grown on their farms, the quality of the product will be improved, the cost will be reduced, and the manual labor required for cleaning and sorting will be eliminated.

Today, based on the results of experimental research, research work is underway to improve the quality of the primary cleaning machine by further separating the grain into fractions.

References

1. J.S. Tukhtabaev, K.F. Uktamov, V.S. Kukhar, O.G. Loretts, O.P. Neverova. The role of industrial enterprises in ensuring food security. IOP Conf. Ser.: Earth Environ. Sci., **1043**, 012023 (2022). doi: 10.1088/1755-1315/1043/1/012023
2. M.Z. Kizatova, S.T. Azimova, G.K Iskakova, F.A. Makhmudov, A.A. Bekturganova. The introduction of pectin-containing foods for the competitiveness of enterprises. Entrepreneurship and Sustainability Issues, **7(4),** 3191-3199(2020).
3. O. Y. Voronkova, E. M. Akhmetshin, I. N. Sycheva, R. N. Shpakova, E. Y. Pashkova, A. L. Poltarykhin. Economic mechanism of regulating land relations in the agricultural sector of russia. European Research Studies Journal, **21(4),** 280-291 (2018). doi:10.35808/ersj/1120
4. M.K. Barcho, O.V. Otto, H.A. Hajiyev, V.O. Samusenkov, L.N. Korshunova, N.O. Vikhrova, N.N. Nikulin. Basic directions for forming perspective forms of agricultural integration. Entrepreneurship and Sustainability Issues, **8(1),** 960-971 (2020). doi:10.9770/jesi.2020.8.1(64)
5. N.N. Chernogor, A.S. Emelyanov. State programs on systematization of legislation in Russia: from doctrine to practice. Voprosy Istorii, **2(1),** 217-225 (2022).
6. M.V. Zaloilo, N.V. Vlasova, D.A. Pashentsev. Climate Change as a Global Challenge in Agricultural Economics. Lecture Notes in Networks and Systems, **205**, 417-422 (2021).
7. Yu.S. Kharitonova. Legal Means of Providing the Principle of Transparency of the Artificial Intelligence. Journal of Digital Technologies and Law, **1(2),** 337-358 (2023). doi: 10.21202/jdtl.2023.14
8. N.N. Chernogor, A.S. Emelyanov, M.V. Zaloilo. Programming and coding functions of law in the evolutionary variability of its social purpose. Voprosy Istorii, **3(2),** 90-98 (2022).

9. V.V. Gushchin, A.S. Korsunova, E.S. Yulova. State regulation of entrepreneurial activity in Russia. Journal of Advanced Research in Dynamical and Control Systems, **12** (4 Special Issue), 1331-1336 (2020).
10. L.Y. Grudtsina, V.A. Baranov. The concept of judge-made law and the interpretation of law by the courts in Russia and Germany. Journal of Advanced Research in Dynamical and Control Systems, **12** (5 Special Issue), 1212-1216 (2020).
11. A.P. Garnov, V.Y. Garnova, L.V. Shabaltina, I.R. Begishev, L.V. Panferova. New opportunities for the digital economy: The implementation of an effective state innovation policy. Journal of Environmental Treatment Techniques, **8(4),** 1321-1325 (2020).
12. I.R. Begishev. Limits of criminal law regulation of robotics. Vestnik Sankt-Peterburgskogo Universiteta. Pravo, **12(3),** 522-543 (2021).
13. A. Zharova. Introducing artificial intelligence into law enforcement practice: The case of Russia. Annals of DAAAM and Proceedings of the International DAAAM Symposium, **30(1),** 688-692 (2019).
14. V. Elin, P. Panfilov. Technological and legal issues of identifying a person on the internet to ensure information security. Annals of DAAAM and Proceedings of the International DAAAM Symposium, **29(1),** 0471-0478 (2018).
15. A. Zharova. Ensuring the information security of information communication technology users in Russia. International Journal of Cyber Criminology, **13(2),** 255-269 (2019).
16. E. Gromova. The free economic zone of the republic of crimea and the federal city of Sevastopol. Russian Law Journal, **6(3),** 79-99 (2018).
17. D.B. Ferreira, E.A. Gromova, B.O. De Farias, C.J. Giovannini. Online Sports Betting in Brazil and conflict solution clauses. Revista Brasileira de Alternative Dispute Resolution, **4(7),** 75-87 (2022).
18. V.V. Kvanina, A.V. Spiridonova. The governmental support for female entrepreneurship. Woman in Russian Society, 4, 52-65 (2020).
19. K.D. Astanakulov, A.D. Rasulov, K.A. Baimakhanov, Kh.M. Eshankulov, A.J. Kurbanov. IOP Conference Series: Earth and Environmental Science, **848,** 012171, (2021).
20. Official statistics. URL: https://www.fao.com/statistics/mung beans.
21. X.A. Idrisov, A.N. Xolboev. *Areas and productivity of mosh cultivation in the world and in Uzbekistan*. Proceedings of the conference on scientific and practical research, 7-9(2020).
22. K.D. Astanakulov, A.D. Rasulov. Scientific and technical journal of Namangan Institute of engineering and technology.
23. A., Rosaboev, N. Makhmudov. Ways to increase the quality of legume seeds. AGRO ILM. –Tashkent, **2**, 32-33(2020).
24. N. Ghulam et al. Mungbean cultivation in Pakistan, 1-7(2012).
25. N. N. Mohsenin. *Physical Properties of Plant and Animal Materials Gordon and Breach Science Publishers* (New York) 90-100(1980).
26. M. Khoshtaghaza, R. Mehdizadeh. Aerodynamic Properties of Wheat Kernel and Straw Materials Agricultural Engineering International: the CIGR Ejournal. Manuscript FP 05 007. Vol. VIII. March, 2006, 1–10 (2006).

27. H.M. Hauhouot, B.R. Criner, G.H. Brusewitz, J.B. Solie. Selected Physical Characteristics and Aerodynamic Properties of Cheat Seed for the Separation from Wheat. Agricultural Engineering International: the CIGR Journal of Scientific Research and Development. July 2000. Vol. II, 1–14 (2000).
28. K.D. Astanakulov. Svoystva pshenitso kak osnovanie dlya proektirovaniya zernouborochno`x mashin [Proprty of the wheat as a base for projecting cereal-harvesting machine] Agriculture of Uzbekistan.–Tashkent, 5. 36–37 (2001).
29. M., Azadbakht, E., Ghajarjazi, F. Abdi-Gaol, E.Amiri. Determination of some physical and mechanical properties of Barkat variety of broad bean Agricultural Engineering International: CIGR Journal Open access at http://www.cigrjournal.org. September, Pp. 1–12 (2015).
30. E. Shimelis, M. Meaza, S. Rakshit. Physico-chemical Properties, Pasting Behavior and Functional Characteristics of Flours and Starches from Improved Bean (Phaseolus vulgaris L.) Varieties Grown in East Africa Agricultural Engineering International: the CIGR Ejournal. Manuscript FP 05 015. Vol. VIII. February, 1–19 (2006).
31. S. Ydyrys, N. Ibrayeva, F. Abugaliyeva, M. Zhaskairat, A. Uvaliyeva. Regulatory and Legal Support for the Development of Digital Infrastructure in Rural areas as a Factor in Improving the Level of Sustainable Development and Quality of Life of the Rural Population, Journal of Environmental Management and Tourism Volume, **5(69),** 2271 – 2280 (2023). doi: 10.14505/jemt.v14.5(69).08
32. P.A. Kuzmin, T.V. Skoblikova, S.A. Gorovoy, O.V. Otto. Research of the state of woody and brushwood plants under anthropogenic stress conditions. Siberian Journal of Life Sciences and Agriculture, **15(1),** 141-163(2023). doi: 10.12731/2658-6649-2023-15-1-141-163
33. G. Singh, N. Kalra, N. Yadav, A. Sharma, M. Saini. Smart agriculture: a review. Siberian Journal of Life Sciences and Agriculture, **14(6),** 423-454(2022). doi: 10.12731/2658-6649-2022-14-6-423-454
34. M.F. Burmistrova. Fiziko-mexanicheskie svoystva sel'skoxozyaystvenno`x rasteniy. [Physical-mechanical properties of agricultural plants]. Selkhozgiz, Moskow, (1956). 164 p. (in Russian)
35. H.J. Singh, De. Dipankar, P.K. Sahoo. Physical properties of soybean cultivated in NEH region of India Agricultural Engineering International: CIGR Journal Open access at http: www.cigrjournal.org. September (2014) 1-5.