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New Technology for Drying Grain and Bulk Materials

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Abstract: The article analyzes the issue of rice grain drying from the point of view of reducing the dimensions of drying plants and reducing the energy consumption of the drying process.

Keywords: rice, moisture, drying, drying methods, magnetron, microwaves.

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According to static data in the world, the area sown with rice in 2016 amounted to 165.22 million hectares, in 2017 - 167.25 million hectares [1], rice consumption in 2017 was 482.727 million tons, in 2018 - 490.266 million tons, in 2019 - 490.266 million tons, 495.87 million tons [2]. Considering the growing production and increasing consumption of rice, it is necessary to dry the harvested crop of good quality for further storage and processing. In this regard, there is a need for the development of new resource-saving technologies and the design of new modernized equipment that allow to meet the high-quality storage requirements for moisture and agrotechnical requirements for the germination of dried grain.

In the practice of post-harvest processing, due to high-quality drying of rice grains, to reduce the crushing of grains during subsequent treatments. In this field for drying rice, one of the main challenges is the development and production of compact, inexpensive, easy-to-use and energy-saving equipment.

Various varieties of rice are grown in the conditions of the Republic of Uzbekistan. In 2018, the harvested crop amounted to 186 thousand tons. In 2019, 400 thousand tons. In 2020, farmers and dekhkan farms sowed rice on 128 thousand hectares of land in 26 districts, which is 54 hectares more than last year, and 614 thousand tons of rice were harvested. [https://kursiv.uz/news/ekonomika/2020-07/uzbekistan-narastil-proizvodstvo-risa]. After harvesting wheat as catch crops, rice sowing and growing have been established on farms and private dekhkan farms. Based on climatic conditions, the harvested crop is subjected to radiation drying in the open air, this method consists in the fact that threshed rice is grown in a small thickness on asphalt areas under salt and is periodically mixed. Drying lasts 3-4 days, depending on the air temperature and the hours of sleep.

Sown rice as an intermediate crop to ripen in autumn to the months of October and November, depending on the variety and the growing season. By this time, a decrease in temperature is observed and precipitation in the form of rain is increasing. The consequence of which is a decrease in the quality of rice drying and, accordingly, an increase in crushed grain after processing, which determines the presentation of the product. In some cases, due to the lack or lack of small-sized and mobile drying equipment, the entire harvest of farms and dekhkan households becomes unusable. Rice can be dried without any problems on sunny days, but in cloudy weather or during rain, the crushed rice must be collected in a shaft and covered with a moisture-proof film. If the volume of rice is larger, then the production of such work becomes more complex in terms of time and labor costs. In addition, the described method, due to the imperfection of the drying technology, does not allow the entire layer to be dried equally and to determine the actual moisture content of the dried mass. In the subsequent processing of rice grain, crushing occurs and the crushed fraction can be up to 50%. Therefore, farms and dekhkan farms are in need of technical means for drying rice [3].

The traditional drying method is based on the transfer of heat by a radiation method, under the infrared rays of the saline, a layer of grain heats up, the moisture content evaporates and is discharged into the atmosphere. The thickness of the dried layer of rice grain should not exceed 20 cm, the thinner the layer thickness, the more efficient the drying will take place. The thickness of the dried layer of grains of golden beans and corn should not exceed 5-10 cm. When drying in this way, a large area with an asphalt surface, earth and concrete areas will be required, in the last two areas under the grain an insulating layer is laid to protect it from moisture. The upper surface of the dried layer of grain should have grooves in the direction from south to north, this is due to the fact that the grooves have more heat transfer surface than a flat surface. At the same time, the partial vapor pressure of the upper and lower layers increases, which leads to an increase in the intensity of moisture evaporation. The advantages of this method are that, eliminating the need for fuel, electricity, biological processes in the grain do not stop after harvesting, sterilization of fungal microorganisms under the influence of ultraviolet rays takes place, and pests that are marketable during storage are cleaned.

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The grain drying process consists of several thermal processes in a specific order. In the initial process with a drying agent, heat is supplied to the grain surfaces. In the second stage, the water, which is bound by the grain, when heated, leaves the grain and passes into a vaporous state. In the final stage, the water converted to steam is carried away by the drying agent into the atmosphere [4].

Currently, there are several methods of drying cereals, in particular rice, which differ from each other mainly in the way of supplying heat to the grain mass. The convective method is the most common method. In this method, the drying agent (heated air) passing from the grain layer, simultaneously supply heat, evaporate moisture and carry it into the atmosphere. With this method, various designs of drying plants are used [5; 145-150-b.]. The cost of drying cereals using heat is higher, but more efficient. The main operations of the technological process are drying and cooling. The layer of grain mass can be movable and immovable. When stationary, the grain speed is equal to zero, the speed of the drying agent is less than the critical speed. The described process is applied in louvered, rack, chamber periodic dryers and intensive ventilation equipment is used [6; 125-127-b.].

The speed of movement of the grain mass with a moving bed is greater than the speed of the drying agent. This method is used for mine, recirculating, drum dryers of continuous operation [7; 162-166-b.].

For convective rice drying systems, the supply of hot air can be carried out along the way, countercurrent, transverse direction and combined methods [8; 44-48-b.].

The modern method of drying is freeze drying, which is distinguished by the highest efficiency, gentle mode and high cost of equipment for the drying process.

Sublimation-type installations operate on the principle of sublimation of ice, in which water, bypassing the liquid stage, passes from a solid to a gaseous state.

In the acoustic method, the mass to be dried is exposed to ultrasonic waves. This process has a cyclical nature, which consists in the fact that ultrasound removes moisture from the surface, moisture inside the grain goes out through the capillaries and the above process is repeated until the required moisture is reached. In this method, the grain mass is dried without heat deception, therefore, the negative consequences associated with temperature are excluded, have a beneficial effect on the physical and mechanical properties and germination of the grains.

With conductive drying, heat is transferred to the grain through the heating surface. When heated, grain moisture evaporates. In this method, a significant amount of fuel will be required, drying is performed unevenly, therefore, it should be applied less often. Due to the increase in the heating temperature (320-340□C), vitamins and biologically active components of the grain are lost and the resulting mass has a tendency to crushing.

When drying with an electric current, the grain mass is placed on a high-frequency electromagnetic field; when exposed to a high-frequency electromagnetic field, eddy currents (Foucault current) appear in the grains. By changing the polarity, the direction of current flow changes. Counter currents, resisting each other, heat the grain. The main disadvantage of this method is its low efficiency. (60%).

Another method of drying with electric current is drying with infrared rays of heating equipment. In essence, this method is identical to the radiation method, the difference from the second is the source of infrared radiation, in the first - the saloon, and in the second - the heating device. Non-red rays penetrate deep into the grain and are half absorbed by water and moisture evaporates. With such a transfer of heat, the heat generated by the heating device is almost completely absorbed by the grain, in addition, due to the destruction of microflora, the products are sterilized.

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In the adsorption-contact method, moisture-absorbing adsorbents are added to the grain mass. This method is distinguished by the absence of costs for electrical energy and materials for heat treatment. Sawdust, silicate gel, calcium chloride, sodium sulfate, etc. are used as adsorbents. or dried grain. Due to additional operations (mixing for drying, separation after drying) it is used less often.

Of the drying methods listed above, the convective method is considered the most promising. Since in this method, heat transfer and moisture absorption in the form of steam occur simultaneously, and this allows you to increase the drying efficiency, save energy, control and regulate the temperatures and speed of the drying agent. The most important advantage of this method is environmental friendliness.

Drying can be carried out continuously or cyclically. In the equipment of cyclic action, the grain mass is dried in portions. In terms of productivity, they can be small (2.5 t / h), medium (15 t / h) and large (more than 15 t / h). They are distinguished by their simplicity of design [9].

The existing grain drying equipment has disadvantages: in terms of its weight and size parameters, it cannot be effectively used in the conditions of small-scale grain production (farms, small enterprises, etc.); the use of hydrocarbon raw materials as a fuel increases the concentration of carcinogens and sulfur compounds in the final product. Taking these shortcomings into account, the authors have developed a small-sized grain dryer for farms, in which air serves as the drying agent; rice and air are heated by a magnetron emitting microwaves (microwave) [10].

Unlike classical methods, grain heating in a microwave dryer occurs not only from the surface of the heated body, but also along its volume containing polar molecules (for example, water), since waves penetrate and are absorbed by the grain at a depth. This reduces the heating time of the grain [11].

As for the issue of drying rice, there is a problem that none of the researchers have taken into account, this problem is that the grain of rice consists of a thin shell covering the density, moisture and thermal conductivity of which is different from the rice itself. Difference between shell and rice properties

References

1. Hayriddinov, B. E., Holmirzayev, N. S., & Ergashev, S. H. (2017). Combination of the solar greenhouse-livestock farms with the subsoil accumulator of heat.«. Symbol of science». International scientific magazine. OMEGA SCIENCE INTERNATIONAL CENTER OF I,(OVATION), 16.
2. Эргашев, Ш., Калонтаров, А., & Нематова, Г. (2020). Инновационная программа профориентации: этапы, цели, задачи реализации. Профессиональное образование, (2), 18-26.
3. Ergashev, S. (2020). PROFITABILITY AND FACTOR ANALYSIS OF AUTO TRANSPORT ENTERPRISES. International Finance and Accounting, 2020(3), 21.
4. Эргашев, Ш. Т., & Хан, И. В. (2015). Создание информационной среды на образовательном пространстве Республики Узбекистан. Образование через всю жизнь: непрерывное образование в интересах устойчивого развития, 2(13).
5. Тухтакузиев, А., Мансуров, М. Т., & Тошпулатов, Б. У. (2019). ИССЛЕДОВАНИЕ РАВНОМЕРНОСТИ ГЛУБИНЫ ОБРАБОТКИ ПОЧВЫ ПОЧВООБРАБАТЫВАЮЩИМИ МАШИНАМИ. In *ВКЛАД УНИВЕРСИТЕТСКОЙ АГРАРНОЙ НАУКИ В ИННОВАЦИОННОЕ РАЗВИТИЕ АГРОПРОМЫШЛЕННОГО КОМПЛЕКСА* (pp. 382-387).

ISSN 2697-2212 (online), Published under Volume 9 in September-2021

ISSN 2697-2212 Online: https://academicjournal.io

6. Ботиров, А. Г., Негматуллаев, С. Э., & Мансуров, М. Т. (2018). ГНЕЗДУЮЩИЙ АППАРАТ СЕЯЛКИ. *Экономика и социум*, (5), 223-227.
7. Ботиров, А. Г., & Мансуров, М. Т. (2017). УСОВЕРШЕНСТВОВАНИЕ ПОСЕВНОЙ СЕКЦИИ. *Научное знание современности*, (6), 48-51.
8. Абдулхаев, Х. Г., & Мансуров, М. Т. (2017). ВЛИЯНИЕ УГЛА НАКЛОНА К ГОРИЗОНТУ ТЯГИ РОТАЦИОННОГО РЫХЛИТЕЛЯ НА ПОКАЗАТЕЛИ ЕГО РАБОТЫ. In *Научно-практические пути повышения экологической устойчивости и социально-экономическое обеспечение сельскохозяйственного производства* (pp. 1219-1221).
9. Мансуров, М. Т., & Расулов, А. Д. (2016). Теоретическое обоснование параметров выравнивателя-уплотнителя комбинированной машины по системе push-pull для предпосевной обработки почвы. *Молодой ученый*, (8), 256-259.
10. Tukhtakuziyev, A., & Mansurov, M. T. (2015). Research of stability of tractor with frontand rear-mounted tools against sidewise skidding. *Tractors and Agricultural Machinery*, (9), 34-35.
11. Tuhtakuziev, A., & Mansurov, M. T. (2015). Issledovanie ustojchivosti traktora s orudijami perednej i zadnej naveski protiv bokovogo zanosa. *Traktory i sel'hozmashiny*, (9), 34-35.
12. Tukhtakuziev, A., & Mansurov, M. T. (2015). Research of resistance on the tractor equipped with implements at front and backside lift hitch contrarily the sidewise skidding. *Europaische Fachhochschule*, (6), 76-77.
13. Tuhtakuziev, A., & Mansurov, M. T. (2015). Issledovanie ustojchivosti traktora s orudijami perednej i zadnej naveski protiv bokovogo zanosa. *Traktory i sel'hozmashiny*, (9), 34-35.
14. Мансуров, М. Т., & Тухтакузтев, А. (2015). Исследование устойчивости трактора с орудиями передней и задней навески против бокового заноса. *Тракторы и сельхозмашины.-2015.-№ 10.-С. 34-35.*
15. Тухтакузиев, А., & Мансуров, М. Т. (2015). Исследование устойчивости трактора с орудиями передней и задней навески против бокового заноса. *Тракторы и сельхозмашины*, (9), 34-35.
16. Тухтакузиев, А., & Мансуров, М. Т. (2015). Исследование устойчивости прямолинейного движения трактора с орудиями передней и задней навески. In *Интеллектуальные машинные технологии и техника для реализации Государственной программы развития сельского хозяйства* (pp. 125-128).
17. Тухтакузиев, А., & Мансуров, М. Т. (2015). Исследование устойчивости прямолинейного движения трактора с орудиями передней и задней навески. In *Интеллектуальные машинные технологии и техника для реализации Государственной программы развития сельского хозяйства* (pp. 125-128).
18. Тухтакузиев, А., Мансуров, М., Расулжонов, А., & Каримова, Д. Научные основы обеспечения равномерности глубины работы почвообрабатывающих машин. *Ташкент: Издательство TURON-IQBOL.–2020.*
19. Абдулхаев, Х. Г., & Мансуров, М. Т. (2017). Влияние угла наклона к горизонту тяги ротационного рыхлителя на показатели его работы. In *Научно-практические пути*

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повышения экологической устойчивости и социально-экономическое обеспечение сельскохозяйственного производства (pp. 1219-1221).

20. Мансуров, М. Т., & Тухтакузтев, А. (2015). Исследование устойчивости трактора с орудиями передней и задней навески против бокового заноса. *Тракторы и сельхозмашины.-2015.-№ 10.-С. 34-35.*
21. Tukhtakuziev, A., & Mansurov, M. T. (2015). Research of resistance on the tractor equipped with implements at front and backside lift hitch contrarily the sidewise skidding. *Europaische Fachhochschule*, (6), 76-77.
22. Тухтакузиев, А., Мансуров, М., Расулжонов, А., & Каримова, Д. Научные основы обеспечения равномерности глубины работы почво-обрабатывающих машин. *Ташкент: Издательство TURON-IQBOL.–2020*
23. Мансуров М.Т. Научно-технические решения агрегатирования почвообработывающих машин, состоящих из рабочих частей, навешиваемых спереди и сзади на колесные тракторы. Автореферат дисс. ... доктора техн. наук (DSc). – Ташкент, 2018. – 54 с.
24. Qosimov K., Yuldashev Sh. Erosion of the working surface of the metal to weld sheeting with the metal powder and surpassing solid for metals' erosion. International Journal of Advanced Research in Science, Engineering and Technology. vol. 6, Issue 10, October 2019.- h. 11147-11152.
25. Mansurov M.T, Nabijanov M.M. Factors influencing the work of parts and its exclusion methods // The collection includes scientific-materials of the International conference participants on the theme of "Innovation in mechanical engineering, energy saving technologies and increasing the efficiency of using resources". Part 1, May 28-29, 2021 Namangan city. – PP 119-124.
26. Mansurov M.T, Yusubjanova M. // Modern methods of diagnostics of main pipelines analysis // The collection includes scientific-materials of the International conference participants on the theme of "Innovation in mechanical engineering, energy saving technologies and increasing the efficiency of using resources". Part 1, May 28-29, 2021 Namangan city. – PP 475-476.
27. Pardaev, M. Q., & Mamayunusovna, P. O. (2020). The 7P model of self-employment. American Journal of Economics and Business Management, 3(2), 45-54.
28. Pardaeva, O. M. (2017). HOME-BASED ENTREPRENEURSHIP AS A SOURCE OF REVENUE GENERATION IN THE SERVICE SECTOR. International Journal of Innovative Technologies in Economy, (5), 16-19.

ISSN 2697-2212 (online), Published under Volume 9 in September-2021