CREATION AND IMPLEMENTATION OF AN INDUSTRIAL PROTOTYPE OF THE PTCS DEVICE IN PRODUCTION

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Abstract: There are growing appeals for the tilting chamber (TC) technology equipped with the "PTC-S" device, which is a profound improvement of the technology of mechanized harvesting of cereals, fodder and oilseeds; and other existing technologies in the field of transportation of beveled crop into the threshing and shredding chamber, etc. That is why TC equipped with "PTC-S" refers to the new generation of working tools for transporting the crop from the harvester or pick-up to the threshing and separating device of the harvesting machine. The development has significant advantages, among which the main ones are: a significant increase in energy efficiency, reduction of quantitative and qualitative grain losses during harvesting, etc.

KEYWORDS: HARVESTING MACHINE, TILTING CHAMBER ADAPTATION, GRAIN LOSSES, EFFICIENCY, IMPLEMENTATION IN PRODUCTION.

1. Introduction

Usually, harvesting of non-uniformly ripening crops begins a earlier than their full ripeness. Unfortunately, this approach results in problems related to partial immaturity of the freshly harvested seeds. Their humidity index is quite high, although lower than in the initial stages of seed maturation. The activity of the enzyme complex is below the maximum level, but the biochemical processes in the seeds are still intense. As the matter of fact, the processes of synthesis of lipids and other spare substances in seeds are almost complete (this is proved by the fact that seeds reach harvesting ripeness) and the content, for example, in oilseeds, oil can grow only in the most immature seeds.

The activity of biochemical and physiological processes in individual groups of seeds harvested within the time limits recommended by the agrotechnical standards can significantly vary. This is due to the diversity of seeds, as well as the difference in the humidity of seeds harvested at different times of day and under different weather conditions.

Thus, freshly harvested seed mass is characterized by incompleteness of maturation and as a result by high instability to the influence of external unfavorable factors during further storage.

Due to the high biochemical activity of the mass of freshly harvested seeds as a biological system is in an unstable state. Seeds are easily subjected to profound and destructive changes, which leads to their death as living organisms. In order to preserve freshly harvested seeds, it is necessary to create special conditions for biochemical processes to proceed in the desired direction. Under the appropriate storage and treatment conditions, the maturation of the freshly harvested seeds continues after the harvest, i.e. they are ripened after the harvest. In this regard, the minimization of macro- and micro-deformation of priority crops during the mechanized harvesting contributes to the reduction of deep destructive changes in the productive part of the harvested crop.

Increased requirements for food security and quality of production of cereals from grain of domestic varieties of grain and legumes, seeds of fodder and oilseeds, which is in high demand and ensures competitiveness in the domestic market, as well as access to foreign markets require the creation of regional technologies and effective working bodies of the new generation for the production of priority types of crops.

In this regard, the introduction of technology of harvesting by means of PTC-S, which allows to minimize quantitative and qualitative losses during the harvesting of cereals, seeds of fodder and oilseeds, is an urgent and priority task.

2.1. Preconditions and means for resolving the problem

One of the ways to reduce the quantitative and qualitative losses of agricultural crops, as well as increase the performance of harvesting machines, is created in the development of the family of inventions. Executed theoretical, methodological and practical aspects of creation and development of new families of lowering harvesting machines [1-20, etc.] will be able to solve technical problems of harvesting grain, fodder and oilseed crops in close connection with resource saving.

Objective: to establish small-scale production, to provide services to introduce and increase the investment attractiveness of PTC-S and a new-generation tilting chamber for cleaning machines.

2.2. Solution of the given problem

Adjustment of PTC-S to the inclined chambers of harvesting machines is designed for transportation of biomass of priority crops into the threshing machine, preliminary leveling of biomass and separation of grain to the threshing machine. PTC-S meets all requirements of the Kazakhstani market and modern achievements of the world combine building. According to expert estimates, the new generation of TC approaches any crops in Kazakhstan. It can be used in fields with different degrees of crop yield: from low (8 c/ha) to high (40 c/ha) and regardless of agroclimatic zones.

The dynamics of grain production in the Republic of Kazakhstan tends to grow.

Marketing researches conducted on the market of harvesting machines show that the market - with the existing level of prices and quality parameters of products can become a leading manufacturer of devices "PTC-S" for threshing and harvesting of priority crops.

Prospects for the development of the market of cleaning technology by means of "PTC-S" allow us to predict an increase in the volume of services provided, sales and appropriate utilization of production capacity of the company.

Implementation of innovative technological and technical solutions will make it possible to create and improve the harvesting machine, significantly reduce losses of grain and seed crops during harvesting, improve their quality, improve the sanitary and hygienic condition of grain products, including increase: commodity, sowing, productive and immune qualities of seeds, as well as their resistance to storage.

The target market is the global market for cleaning equipment. This innovation is not only regionally advanced, but also globally advanced, so the global demand for post-commercialization products is projected to be strong.

2.3 Results and discussion

Advantage of development over existing technologies:
1. Energy efficiency. Proposed for commercialization energy-efficient TC with PTC-S allows to reduce up to 10% of energy consumption during the threshing of beveled crops to the same degree of threshing compared to a combine harvester with a
2. Reduction of quantitative and qualitative losses of grain in the process of harvesting and threshing of the crop. Due to its specific construction, the energy-efficient TC with PTC-S is able to equalize the uneven beveled mass at discharge. This is achieved by adjusting the V-shaped edge of the TC corrugation (when harvesting high yielding mass, more than 15 c/ha) or by adjusting the flow of process media passing through the chamber (when harvesting low yielding mass, less than 15 c/ha).

3. Increased cleaning performance. Due to the work in the mode of biomass leveling and partial separation of grain to the drum, the power required for its drive is reduced, because the drum receives some deformation of the stems and ears, in addition, in the area of the tilting chamber with PTC-S part of the grain and fine impurities is released, resulting in the drum receives less weight, the dragged layer of biomass is softer to work drum easier. At the same time, there is less under-harvesting and crushing and micro-damage of grain; the throughput capacity of the MSU combines is increased with the allowable under-harvesting.

As a result, all the advantages of TC with PTC-S, including, first of all, energy efficiency, reduction of losses, increase of productivity, allow to obtain significant savings in capital and operating costs of production.

The gross grain yield is increasing up to 10% and its quality is increasing due to the reduction of macro and micro-damage (crushing) percentage up to 8%.

The main advantage of the TC with the device "PTC-S":
- removes the biologically valuable part of crops with the least losses;
- increases the productivity of grain threshing by 10-15%, which leads to a reduction in the harvesting time of grain and grain crops in the country by 6-8 days;
- reduces the quantitative losses during grain harvesting to 10-20%, i.e. for the area of 14 million hectares with a yield of 10.0 centners per hectare and gross grain harvest of 14 million tons, the effect of reducing losses at the stage of implementation of 5-10%, will be 17.5 billion tenge, per the expected volume of gross grain harvest (0.7 million tons x 25,000 tons = 17.5);
- reduces macro- and micro-deformation of seeds in 2 - 3 times, and thus increases seed germination and an additional addition to the yield of 1-3ts/ha, i.e. 4.2 million tons. (14 mn ha x 1.5 c/ha = 2.1 mn t), i.e. get 52.5 bn t (2.1 mn t x 25,000 t = 52.5 mn t);
- Reduces the number of harvesting units on the operations of mowing and threshing of grain by 10-12%;
- Reduces the need for sowing areas for grain up to 10-15%;
- Reduces the need for fuel and lubricants for harvesting operations to 15-20%.

Additional consumer properties as compared to those sold on the market:
- High energy efficiency. A new generation of PTCs with PTC-S is much more energy efficient than traditional tilting chambers for combine harvesters.
- Reduction of quantitative and qualitative losses of grain in the process of harvesting and threshing of the crop. New generation TC with PTC-S is able to equalize the uneven beveled mass at unloading, which allows to minimize grain losses and avoid excessive loads on threshing.
- Reduction of capital and operating costs. Due to high energy efficiency and reduction of grain losses, increase of productivity of the new generation of oil and gas companies allow to significantly reduce the cost of production and the cost of grain products, etc.

2.4. Conclusion

During the development process, products in the form of threshing and harvesting technology for grain, fodder and oilseeds will be sold by means of the "PTC-S" device (under a license agreement) and an industrial prototype of the "PTC-S" device for harvesting machines.

Income from commercial activities is planned to be received through the implementation of the license agreement for technology, finished products and services.

2.5. Literature

1. Report on scientific research work on the theme "To develop and implement the technologies of grass seed cleaning and technical means for their implementation" // SAPA RTC LLP, No. 0101RK00363, Almaty, 2005, 50 pp.


7. Sadykov J.S., Espolov T.I. and others. Metal distributor for combine harvester // Description of invention for patent No. 257772. Opul.15.05.2012, Bulletin No.5.

8. Sadykov J.S., Espolov T.I. and others. Method for determining the biomass equalization coefficient of the combine and the device


12. Sadykov Zh.S. Technological and technical solutions of the problem of the phytomeliorant forage crops harvesting on the arid pastures: Abstract of the diss... of a PhD in Engineering. /WIM, Moscow, 1993, -41c.


18. Makasheva E.D. Development of economic relations in the formation of the centralized grain funds in Kazakhstan: Author of the disser... a PhD in Economics. /KazNII of Economics and AIC organizations, Almaty, 1990, -18c.
