

## **THE DEVELOPMENT AND APPLYING OF FLEXIBLE TECHNICAL FACILITIES IS EFFECTIVE WAY OF AGRICULTURAL PRODUCTION MECHANIZATION IN INDUSTRY**

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**Summary.** The effective way of agricultural production mechanization is grounded by development and applying of flexible machines, technological processes in industry.

**Key words.** Flexibility, mechanization, uncorn part of harvest, complexes of machines, efficiency, estimation, research.

### **INTRODUCTION**

The special machines and machine complex are being developed for harvesting of biological yield of grain crops, for laying-in and preparation of forage and for other technological processes for a long time.

The primary purpose of specialization is achievement of high technical and economic indexes by adaptation of machine construction to the concrete terms of its work. Such approach predetermined development and raising for production mainly of single-purpose agricultural machines, complexes, here the conception of creation of different modifications machines developed depending on the natural and climatic areas of country, cultivated crop varieties.

However we, that one of effective ways of agricultural production mechanization was development and applying of flexible machines, complexes, technological processes in industry.

### **OBJECTS AND PROBLEMS**

Research objects in this work are machines, machines complexes and technology of harvesting of uncorn harvest part (UHP) of grain-crops.

## RESULTS OF EXPERIMENTAL RESEARCH

Planning of machines, complexes, as is generally known, conducted on the basis of average information, for example, according to yielding capacity, the weather conditions etc. Agriculture is a such industry in which main resources are climate and soil, that, is not human making resources of nature. Consequently, while we do not know how to control the weather, it is necessary to adapt farm works to the climatic conditions skillfully.

As appears from the above, that designing of technical facilities on the basis of average information does not answer the varied terms of agricultural production, essentially it is more, for example, cultivation harvesting and use of all biological grain crops yields.

From an analysis, for example, in order to settle problem of machine harvest and using of uncorn harvest part, it is necessary to work out and introduce the whole set of machine complexes in agricultural production and these complexes will successfully fulfill in all range of changing natural and climatic areas.

However, the development and production of multinomenclature set of machines is ensive mechanizationconstrained by limited resources in industry and agriculture. Besides, the task of the comprehension in the agricultural operations and also the continuous technological advance in engineering predetermines the production's development and organization and also a big amount of the new agricultural machines and the scientific and technological revolution requires a frequent renewal of the agricultural machinery.

The growth of the number and range of machinery in agriculture makes organization of their production, their operation, maintenance, repair, spare parts' supplement much harder. By the production of the agricultural machinery the manufacturer's and consumer's interests are opposite. While the consumer tends to increase the range of machines what leads to the batch in production, manufacturers are interested in reducing of the product's cost, and this is ensured by the development of specialization and mass production.

Suitable technologies and machine systems for cleaning and using of the tailing for their realization forecasts the providing of a modern combine harvester with seven major special devices that provide various technological schemes cleaning of tailing (for example, swathing ones with pounding of tailing).

For realization of the considered technologies it is necessary to find production facilities, metals, labor, and to organize the production, for example, seven types of mechanisms for a combine harvester with a total mass, about 3500 ... 4000 – kg that requires considerable material and labor resources.

The abovementioned contradiction between the consumer and the manufacturer is a problem that can be solved through the creation and production of flexible devices, machines and systems, that adapt to the fulfillment of other effective technological processes and that react by rapid setup to the changed conditions in the process of cleaning depending on the interests of economic and prevailing conditions.

The analysis of the published data and review of the scientific researches and development works demonstrates that there is no novelty of a revolutionary character in such technologies like the harvesting of the biological yield of grain crops. The main

efforts of scientists and experts focus on improving productivity, high power and reliability of machines, improving the conditions of maintenance, reduction of material, organization of their rational exploitation, etc.

Theory and practice show that reserves of troubleshooting are hidden exactly in the technology. One of the ways to solve the problem of mechanization of harvesting and use of tilling, harvesting and preparation of feed is the development of new processes and realizing their machines, characterized by flexibility.

Based on this analysis, we first put forward the concept of an effective tilling's mechanization of harvesting grain crops through the development and implementation of an agricultural production system to the flexible universal combine harvesters that adapt to the execution of viable technologies and implement the complex of their machines.

In summary, a flexible machine or a complex refers to the property to be able quickly and by minimal labor and material costs to adapt to the execution of another process within the limits of their technological capabilities.

The flexibility of the technological system must be economically justified and to guarantee a high performance and production quality. Included flexible machine must have a high reliability design and a manufacturing process, as well an ease of maintenance and changeover at the possibly highest and economically justified level of automation and mechanization.

The use of flexible technology systems has the following advantages:

- easier and cheaper transition to a new product or process at the expense of flexibility of the system;
- provides a more complete satisfaction of the customer's and the consumer's claims;
- the technological process intensifies by increasing the shift coefficient of loading harvesting and feed-preparing units, a production cycle of harvesting reduces;
- lower material equipment for harvesting.

Flexible technological systems have an advantage over rigid systems in the case when you need to readjust to the execution of other processes that is especially important by performing of a very fleeting field work in agriculture. The potential flexibility ( $F_p$ ) of a technological system is the ratio actually laid down and attainable flexibility ( $F_a$ ) to the desired value of flexibility ( $F_{dv}$ ), for example, on the technical task of (TT):

$$F_p = \frac{F_a}{F_{dv}} \quad (1)$$

$F_p = 1$  - a flexible system that satisfies TT,

$F_p > 1$  - there is a reserve of a system for flexibility,

$F_p < 1$  - a flexible system can not be designed.

In a flexible technological system for the mechanization of agricultural processes, the concentration of manufacturing operations on one machine is always desirable, since in this case the total number of machines in the system is minimized, which enhances its technical and economical index.

Incorporated in flexible machines and systems working bodies and elements, the range of variation of parameters and regimes constitute a so-called area of technological possibilities of the complex and machines, devices for cleaning or the tailing's preparation or procurement and cooking of feed that defines its technological capabilities.

Our research and development activities [1, 2, 3] and generalizations [4] allowed us to formulate the eight basic principles for the development of flexible systems for the mechanization of agricultural production. The development of flexible systems should be based on the following basic principles:

- modular design with separate exchangeable or fast reorganized work submodules with operational control over their work,
- minimum possible amount of time that is required to adapt the machine to a new technological process,
- concentration of manufacturing operations and the combination on the same machine with varied technological processes,
- maximum possible approximation to the basic technological process, executable by the machine and the additional manufacturing processes,
- minimizing the number of machines in the processing facility,
- possible mechanization and automation of machine's changeover to a new technological process, changing working bodies and their corrective maintenance depending on the physical and mechanical properties of the processed product, weather conditions, etc. (application programmable command device, etc.),
- zonal configuration of supply,
- redundancy flexibility by taking into account the moral and physical wear of the system during the regulatory period of operation.

The principle of flexibility, redundancy, taking into account the moral and physical wear of the system is very important for the development of a flexible system during the regulatory period of operation.

The concept that we have developed has found practical application.

Developed with the direct creative participation of the authors and put on a mass production factory "Kalitvaselmash" OJSC Rostselmash a flexible universal device PUN-5 for the cleaning and the use of tailing for the grain harvesters SK - 5 "Niva" [1,2]. There have been released more than 400 thousand piece of combine SK - 5 "Niva" with PUN - 5, and these systems have found their massive use in Ukraine and CIS countries.

It was developed and implemented flexible manufacturing system DON-1500 for a high performance grain harvester DON-1500.

It was designed with the direct participation of the authors flexible compact procurement unit FTI-1 that was released on an experimental batch. It provides the preparation of different feeds by twelve technological schemes. The concept of universal design of flexible systems was recorded on GSKB complexes forage and grain cars TO Gomselmach to create energy resources "Polesie-250"

Accomplished by authors designs were also used in the creation of combine harvesters KZR-10 and KZR-10 "Polesie-Rotor" set for production in the Republic of Belarus.

## CONCLUSION

1. Conception of development of flexible hardwares, adapting oneself on expedient technologies, for example, on cleaning up and use of UHP, purveyance and preparation of forage, answers both the requirements of agricultural machine building and requirements of agricultural production on complex mechanization of agricultural processes. It is confirmed by the created hardwares, applied in industry.
2. The basic characteristic indexes of the flexible system it is been: flexibility, time on adaptation, technological potential, vitality, productivity and efficiency.
3. The effective use of the removable module of the flexible system can be carried out due to giving to it multifunctionness, flexibility and minimization of time on a readjust.
4. At planning of the flexible system it is recommended at once to mortgage reserve, perspective flexibility taking into account the moral and physical wear of the system.

## REFERENCES

1. Shapovalov V., Gadgets PUN-5 to combine SK-5 "Niva". - Engineering in Agriculture, 1976, № 6, pp. 48-53.
2. Shapovalov V., Universal device for harvesting machines for harvesting of tailing. - Mechanization and electrification of agriculture, 1984, № 9, pp. 33-37.
3. Shapovalov V, Volik I., A efficiency technologies and systems of machines, due to the use of adaptive devices such as PUN. - Mechanization and electrification of agriculture, № 8, 1986.
4. System design of flexible technological systems in mechanical engineering. Abstracts Workshop ed. NG Nayanina. Vladimir BOC NTS, 1982.

## РАЗРАБОТКА И ВНЕДРЕНИЕ В ПРОИЗВОДСТВО ГИБКИХ ТЕХНИЧЕСКИХ СРЕДСТВ - ЭФФЕКТИВНЫЙ ПУТЬ МЕХАНИЗАЦИИ СЕЛЬСКОХОЗЯЙСТВЕННОГО ПРОИЗВОДСТВА

Шаповалов В. И., Нежинский Я. И.

**Аннотация.** В работе обосновано эффективное направление механизации сельскохозяйственного производства путем разработки и внедрения в производство гибких машин, технологических процессов.

**Ключевые слова:** гибкость, механизация, незерновая часть урожая, комплексы машин, эффективность, оценка, исследования.